The Electrical Review

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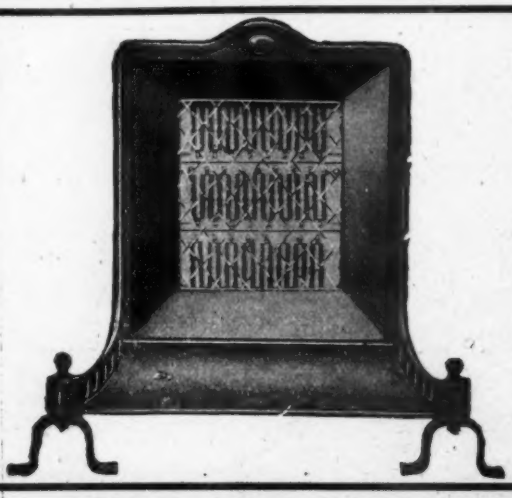

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TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving his copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

THE INDUSTRIAL SITUATION AND "WHITLEYISM."

NOBODY in the industrial world is surprised that, hostilities against the Central Powers having ceased, we find ourselves amid wars and rumours of wars at home. It was quite expected that it would be so, though perhaps some of us had imagined that we should have been permitted to dwell together in comparative unity until Peace was actually signed. The reason for our disappointment is, doubtless, to be found in the conditions that have proved to be inseparable from the more or less sudden cessation of war manufacturing; but, if we may be permitted to be quite frank, the cause is also to be found in the selfishness of our human nature. We are reluctantly driven to the view that we never should have preserved the semblance of a solid front, enabling us to defeat the most abominable of foes, unless the "working classes," as we used to call them, had received plenty of money and practically every demand that they had thought fit to present. We are a great people, but we are the same people, in some important respects, as before the war, notwithstanding all the purifying influence of our common losses and our common anguish. We are racking our brains to secure a League of Nations to prevent international catastrophe by establishing the framework around which a common brotherhood may grow, but no League of Nations can prevent internal disagreement and strife; only a league of all the classes and interests within the British nation can safeguard us in this respect. Who at this moment intelligently reading the signs can say positively that we are ready for that? Yet unless we can move more rapidly than we have been doing in such a direction, prosperous living will be impossible for anybody before very long. We are al advancing our needs and our claims—sometimes legitimately, *sometimes not*—for "something more." Where, in the last stage, is it to come from? Perhaps the most general demand is for a larger share of the return made as the result of the employés' efforts, a demand made for reducing the employer's share of the profit on his capital, original or increased, as the result of labour's activities, or for lessening the rate of the dividend on the capital invested by outsiders whom we call share or stock holders. But, as matters stand, those reductions cannot be introduced without capital, the life-blood of industry, being alienated and enterprise starved, unless the cost of the articles of which we are all consumers is raised to remunerate both Labour and Capital. We have seen scores of times during the war how this sort of thing operates, and now that we are "settling down" (save the mark!) to Peace, we see it again. The miners make demands for higher wages and shorter hours, which, in the absence of more efficient service per man, means that we all pay still more per ton for our household fuel and so much more per thousand feet of gas. The educational authorities put up the salaries of teachers, municipal employés gain their advances, and they and we together grumble because our local rates have reached unconscionable figures. The railway men make their demands and we pay more for travel; the rates for goods traffic will also bear the burden, and industry must be handicapped by costlier fuel and costlier transport. We tax house property to such an extent that it reaches almost the breaking-strain point, and at the first opportunity the landlord must transfer the burden to the tenant, or the property will not be worth the

holding. Yet we all live in the hope that the cost of living will go down—some day! We seem to be in a glorious state of chaos, and the end is not in sight. Indeed, perhaps we are but at the beginning of our troubles—are there not public prophets who say that "two months hence," or, "at any rate, by next October," we shall be at the maximum point of unrest?

It is easy to be gloomy deans; to review the situation and the tendencies thus: to criticise each other; yet while we watch the barometer, it is incumbent upon us also to prepare to weather the storm or avoid for the people generally the effects of some of its ravages. We might prevent even the storm itself if we, as a nation, sat down in the right spirit and with a very definite determination to that end. Some effort along that line has been made—it was very slow and half-hearted at first, though it is more progressive and spirited now—by the propagation of what Judge Parry has aptly described as "Whitleyism." Industrial Councils have been set up in a number of important industries, and good influences are at work in consequence. But some other leading industries will not touch it. Who is to blame? The Government was right at the beginning very slow in bringing out for exhibition its Whitley baby; yet its spokesmen praised its juvenile merits, and believed it to contain elements of great promise when it became more fully developed. And then what did the Government do? Left it to starve so far as Government sincerity was concerned. What was the reason for such action? Why did not the Government prove to the industrial people of the kingdom that its beliefs in Whitleyism were so sincere that it would adopt it for Government industries—for Government departments which could be considered fairly comparable with private undertakings? According to Judge Parry's most excellent criticism at last week's meeting of the Industrial Reconstruction Council, it is the Treasury, and the Treasury alone, that is responsible for the turning down of Whitleyism for Government departments. Let the Treasury consider, then, in these serious times how much it has, or may have, to answer for. It is inconceivable to us who do not know the whole story, that permanent officials—even a department which is hoary with age, doubtless has settled down in a rut, and needs blowing out with explosives—should be permitted to obstruct, because of precedents, or objections to new departures, or because of inability to face the fresh breezes, the newer atmosphere, of these days, the course of a movement which might, if the Government example were available, make a far more speedy advance. Who can pretend to be surprised if some reply to the Government commendation of Whitleyism, "Physician, heal thyself!"?

If masters and men are to co-operate in the efficient conduct of industrial undertakings, through Industrial Councils and Committees, which should be able to obviate many disturbances such as are now prevalent in many directions, the employés require to have confidence in the proposed principle. The men will have nothing to do with Committees which are to do nothing but talk. There is an inclination still to leave them alone as traps or devices which will prevent the fulfilment of what they regard as their legitimate right—a larger voice in the conduct of the business in which they are employed, and a reasonable share in the profits which it can be made to produce. If they can be brought to see that in Whitleyism there is to be found the only practical scheme yet announced for securing that end, their indifference or opposition may be transformed to sympathetic listening and possibly active support. But the Treasury—a Department of the Government itself—Government which ought to be bringing its whole mind and influence into the task of securing industrial peace, is blocking the way in this very necessary enterprise, as it has too often done with others in the past. How long will men put up with it? The Treasury seems to have unlimited authority—even a decision of the War Cabinet that the Whitley principle be applied to Government Departments where operations were similar to those of outside industries, was set aside! As Judge Parry remarked: "The Treasury needs to be converted"; and a right spirit has to be renewed within the bureaucracy.

So long as Whitleyism is taboo in Whitehall who can wonder that it is taboo elsewhere also?

A NATIONAL INDUSTRIAL COUNCIL FOR THE ELECTRICITY SUPPLY INDUSTRY.

The electric supply industry is at the present moment at the cross roads of what is in essence a most revolutionary venture. The proposed constitution of a National Industrial Council for the industry is now before the various Associations and Trade Unions. The industry is practically committed to the formation of a representative Council, but the crucial question of the scope of its activities is now up for decision. Curiously, however, there exists in the minds of many who are vitally interested in the electric supply industry a great vagueness as to exactly what is an Industrial Council, and even a greater uncertainty as to what practical bearing it will have on the every-day working of individual undertakings. Needless to say, therefore, there seems to be a none too serious appreciation of the importance of settling the constitution on the most politic and judicious lines. In the narrowest limits the Industrial Council (consisting of representatives from the Employers' Associations and from the Trade Unions) would settle rates of wages and conditions of labour. In its widest scope it extends to problems of co-partnership and what is practically a share in the administration of the undertakings. The industry is at the present moment called upon to define what the limitations shall be. But in dealing with the matter, it is very necessary that a broad politic outlook should be maintained. The Industrial Council is the solution, proposed by the Ministry of Labour, of the present difficulties of dealing with Labour troubles. The ever-increasing conflict between Capital and Labour threatens all industries alike with disaster. The Ministry of Labour find that the only palliative is the formation of Councils where both sides may meet and come to some sort of temperate settlement on the various questions raised by Labour. The new Industrial Council would, of course, supersede the present Conference of Electric Supply Associations, which, in a tentative way, is at present exercising certain of the functions, so far as its limited consultative powers will allow. Incidentally, it is interesting to note that the question of the Council is raising a somewhat novel problem. Old-fashioned labour trouble was a case of "masters" *versus* "men." In the electricity supply industry, consisting of municipal undertakings or limited companies, there are no masters in this sense. The question has come up (as in the E.P.E.A. controversies) as to whether chief engineers are "masters"—or where the line is to be drawn. The modern problem has virtually shifted from a controversy between masters and men to one between Labour (including even the highest ranks) and Capital in the abstract. The proposed Industrial Councils are, in fact, practically called into being to adjudicate on the very advanced economic problem of the proper proportion of profits claimable by the providers of capital only as against that equitably due to the workers whose energies resulted in the producing of such profits over and above normal interest. A glance at the scope of the Industrial Councils will show that this is practically the basic idea. It is in this sense that we say that the industry has now before it a quite revolutionary measure, and one which cannot be dealt with by the one-time convenient expedient of "shelving."

Electrified Seed.

Last week we published an interesting statement regarding the electrical treatment of seed, which has been so widely adopted in the south-west, from the pen of Mr. H. H. Dunn, a well-known seed expert; to-day we print the views of Dr. Charles Mercier, who has taken a prominent part in the development of the process during the past three years. We are very pleased to place these articles before our readers, first, because we have received many inquiries regarding the subject, and, secondly, because we have for very many years devoted special attention to the uses of electricity in agriculture, and wish to keep our readers informed about every new development in connection with it.

The evidence that has accumulated with regard to the results of the electrical treatment of seed must be admitted to have attained considerable volume, and the subject is clearly well worth careful investigation; the process described is simple and inexpensive, and the increase in yield is of unquestionable importance. Hence, whatever, be the true cause of the increase, the advantage of employing the process appears to be beyond dispute. Our only doubt is whether, in fact, the result is due to the electrification or merely to the chemical action of the treatment. We find that some half-dozen patents have been taken out by the promoters, Messrs. C. E. de Wolf and H. E. Fry, nearly all of which possess in common the feature of soaking the seed in a solution of nitrate of soda, sulphate of ammonia, or other artificial fertiliser, followed by a drying process. Variations are mentioned—such as spraying with petroleum, the use of radio-active solutions, exposure to ultra-violet rays, &c., and usually the passage of a small current ($\frac{1}{2}$ to $1\frac{1}{2}$ amperes, at 200 volts) through the mass of the grain in a wooden tank for a few hours is specified; but in one case (in 1914) no electrical treatment is used. We should like to know whether any considerable fraction of the current passes through the substance of the grains; and, if it does, whether it exercises any beneficial effect upon the organism. The simplest way of putting the matter to the test appears to be to subject two similar samples of seed to the process, omitting the electrical treatment in the case of one of them, and to sow them, with a third sample wholly untreated, under identical conditions.

We do not deny the possibility that the electrical treatment may be essential to success; but we should be glad to have the fact demonstrated by trial.

[Since writing the foregoing we have found that in a letter to a contemporary, Dr. Mercier states that the test suggested, and other tests, have been carried out repeatedly by Mr. Fry, and have proved conclusively that while simply soaking and drying the seed produces an increase in the crop, the effect is not nearly so great as it is when the electrical process is employed.]

National Electricity Supply.

Receiving the report of the Committee appointed by the Council of the I.E.E., on Tuesday, last week, we were unable to give its terms mature consideration before going to press; hence, while we drew attention to its leading features, we were obliged to defer our comments for the time. Since then we have considered the matter at leisure, and have come to the conclusion that in certain respects it is by no means satisfactory.

In the first place, the constitution of the Committee was distinctly one-sided; it was very unfortunate that the two municipal associations that were invited to take part were not represented on the Committee, but even if they had been, their four representatives would have been far too few adequately to impress the views of the municipal authorities upon the Conference. Moreover, these are not the only municipal bodies which, in view of their importance and of the constitution of the Committee, might justly have claimed representation upon that body. Thus the Committee was composed almost entirely of manufacturers and companies engaged in electricity supply and traction, and was thereby laid open to the charge which was immediately levelled against it—that it represented not the electrical industry as a whole, but the commercial branches of it, whose unanimity, we are informed, was "impressive."

The accuracy of the conclusions arrived at and embodied in what we may call the preamble of the case stated by the Committee in Sec. 7, paragraphs *a* to *d*, is unimpeachable; the views there expressed are in the main identical with those formulated by the Board of Trade Committee on Electric Power Supply, which have been amply endorsed by the great mass of opinion in electrical circles throughout the whole country. But in paragraph *e* the brake is put on pretty hard; and while the statement that the Board of Electricity Commissioners should be set up immediately will meet with almost universal approval, which will extend also to the definitions of duties to be assigned to the Board contained in paragraph *f*, the next paragraph, if adopted by Government, would knock the bottom out of the whole scheme. "The functions of the Board should be exclusively judicial and advisory. Strenuous objection is urged against the granting to the Board of administrative powers. . . . The powers of the Commissioners should be limited to examining schemes brought before them." Have we not long enough been governed by King Log, that we should have another wooden idol thrust upon us? The Committee goes on to say (par. *h*): "The preparation of such schemes . . . should be left as a matter of free and natural development to the initiative of undertakers . . . opponents would be entitled to be heard against such Bills in the usual way," and, of course, the Parliamentary counsel would receive the usual fees—"business as usual," in fact. Yet the Committee has declared the necessity of drastic reform in spirit and letter, of the treatment of the problem of electrical generation and distribution on broad lines, and of the provision of simple forms of procedure in obtaining powers for electrical utilities of all kinds. How can drastic reforms be obtained by substituting for the existing system of administration its counterpart? or national problems be treated on broad lines by way of local schemes? or procedure be simplified by merely varying it in appearance without changing the substance?

Admirable as are the expressed intentions of the Committee, these recommendations appear to us to be but lame and impotent conclusions. We feel that the policy advocated by the Committee, while ostensibly in accordance with the scheme of the Committee on Electric Power Supply, would in fact to a great extent rob it of its vitality and effectiveness. The country needs—and demands—a fundamental root and branch reform, such as can only be carried out by a competent authority armed with executive powers, and it wants it quickly. Under this nerveless figurehead of an authority the hope of reform would be deferred till most of us were in our graves.

Let us have a vigorous, determined, self-reliant body of expert Commissioners to tell us what to do—and *to see that it is done!*

We may add, for the benefit of possible correspondents, that we are acquainted with Æsop's Fables.

Electrical Engineers' War Memorial.

The proposal of the Committee appointed for the purpose by the Council of the Institution of Electrical Engineers, to establish a War Memorial Fund in honour of the members who have made the supreme sacrifice in the war, is one which must meet with a cordial response in the hearts of all their brother members. Particulars of the scheme are given in our "Notes" to-day, from which it will be seen that, in addition to a permanent record in the Institution building, a fund is to be provided to assist the wounded and disabled, and the dependents of those who have suffered or have been killed in the war—a plan which will command approval.

The cost of the permanent memorial will be a fixed and final amount; the maintenance scheme will be a running charge, continuing for many years, and it behoves us all who are members of the Institution to do our utmost to ensure that the fund shall be worthy of the Institution and of the great cause to which it will be devoted. Our comrades have cheerfully given all that it was in their power to give—and in doing so they have also mortgaged the happiness and welfare of their loved ones, whom we still have with us; let us honour the sublime trust that is laid upon us, let us discharge this sacred debt, so far as money can discharge it, to the uttermost farthing, and let us not forget that money alone can never make good the loss that these have undergone. We should rejoice that, in the absence of our comrades, these their dear ones remain to us; upon them we can bestow the tokens of our admiration, affection, and gratitude, not as a burden but as a sacred duty which it is an honour to fulfil.

THE SIEMENS & HALSKE CO. ON THE SITUATION.

We recently reproduced an abstract of the speech which Herr Walter Rathenau delivered at the annual meeting of the A.E.G. It may now be of interest to quote also from the address which the chairman of the Siemens & Halske Co. submitted to the shareholders. He said :—

The changes which had taken place since the beginning of August had brought about conditions which were of very serious significance to the whole of German industry. The Armistice and the immense demands of the Allied Powers, the occupation of the left bank of the Rhine, and the standstill of a large part of the industry on the right bank of the river, had placed all industries in a critical situation, which was greatly accentuated through the revolution. The past two months had not been characterised by devotion to work in order to reconstruct industry, but they represented a growing process of dissolution of industrial work and of anarchy. The works were no longer centres of production in the old sense of the word. Political agitation, election meetings, strikes and demonstrations, occupied the time of the workmen. A wages movement of the most extreme violence had proceeded simultaneously with an increasing indisposition to work, and a rapid decline in the average efficiency of the workmen. Whilst wages movements were accustomed to take place in times of active and remunerative employment, the present agitation started when the war orders, which had formed the principal source of activity, were cancelled.

An approximately adequate substitute for war contracts in the form of peace orders, however, was not forthcoming ; it would not arrive so long as everything in the country was topsy-turvy and until the danger of Bolshevism was removed. The number of workmen employed, who received large additions to their ranks through the return of men from active service, and the amount of the wages and salaries which the company was compelled to pay, were in a still greater disproportion to the work performed. This disproportion already endangered most seriously the maintenance of working much longer. On the other hand, demands were put forward which implied an increase of about 50 per cent. in wages and salaries. The concessions thereupon made were of considerable extent. If the efficiency further declined simultaneously with these constantly-growing expenses—an efficiency which had already receded to one-third—and if orders continued to come sparingly to hand while great difficulties stood in the way of raising sale prices, an equilibrium between receipts and expenditure was not possible, and the industry would be no longer able to provide employment for its workmen and officials. It would be immensely difficult to repair the damage produced by these conditions.

The restoration of order and confidence, safety, discipline, sense of duty, and industry was the most earnest question of the hour ; without such restoration it would no longer be possible to maintain the population in some measure sufficiently.

The chairman concluded by remarking that the bringing down of the high costs of production and the prices of goods would be considerably protracted and rendered difficult, and that would continue so long as the exchange of goods with other countries, which was indispensable for the existence of the nation, remained at a standstill.

The "Safety First" Movement.—The British Industrial "Safety First" Association, in a circular just issued, states as evidence of the necessity which exists for immediate action, that the latest published returns show that in 1914 969 persons were killed, and 147,045 were injured by accidents in workshops and factories alone, a large proportion of which would undoubtedly have been prevented had those who became casualties been educated in matters pertaining to their own safety. Millions of pounds paid in compensation, and huge sums of money lost to workers as wages, might have been saved. Many of the largest firms and trade unions in the country, the circular says, are actively supporting the "Safety First" movement, and it is hoped to proceed at once with the preparation of "Safety" notices and literature specially suited for individual industries.—*The Times.*

BRITISH ELECTRICAL TRADE IN CHINA.

III.—The Rewards.

By PROF. MIDDLETON SMITH, M.Sc., M.I.Mech.E., Hong-Kong.

A director of one of the great Japanese steamship companies recently said :—"The Chinese are great buyers, but what they are buying to-day is but a bagatelle of what they will buy to-morrow." For the next 30 years the country of China could, if administered by some international league with European officials on the lines of the Chinese Maritime Customs Service, absorb all of the machinery manufactured in Great Britain, America, and Japan. China, in return, could supply all of the raw materials needed by the world during that period.

The industrial era is just commencing in China. It is in evidence at the Treaty Ports and in Hong-Kong, but those places are only the fringes. Yet one set of figures will give some idea of what stimulus will do in China. In 1916 the value of the tin ore sent from the Yunnan province to Hong-Kong was about £200,000. In 1917 it was valued at more than £600,000. Already for nine months of 1918 the value has been over £2,500,000. That is just one metal. But the mineral resources of Yunnan are almost feeble as compared with those of some of the other provinces.

All over China the natives are demanding electric light. Lamps and accessories are coming from Japan and Britain—it is hoped that more and more will come from "the old country." The Chinese are demanding railways—they have in a few years enormously extended the postal and telegraph systems. The vast plains of Manchuria have trembled beneath the steel of the steam-plough, the rivers re-echo to the noise of steamers and motor boats. Mining machinery has been already imported into China, but the possibilities of this market for such plant are beyond description. Modern mining work inevitably means electric power. A request came to the writer only a few days ago from one of the big mining companies in China, managed by the British, for a graduate in electrical engineering. The plant, as described in the letter, was quite up-to-date. It ought to be possible to equip many such plants in China in the next few years.

Docks and Shipping.

It is worth noting that during the last few months of the war hard-headed business men and engineers in China have advanced schemes and suggestions for the extension of the existing harbours of China. The Hon. Mr. David Landale, head of the largest merchant business house in the Far East, and a member of the Legislative Council of the Colony of Hong-Kong, recently mentioned in that assembly the matter of the local harbour, which to all appearances could now almost hold all of the shipping of America and Europe. But Mr. Landale wisely warned the Government to be prepared. The Chinese authorities have issued reports from a capable European engineer, Capt. Olivecrona, upon the improvement of the Port of Canton and the West River, that great artery of trade in Southern China. In Shanghai three expert engineers have produced a most voluminous report for the Whampoa Conservancy Board, which says, among many other things of great interest to manufacturers, that "the trade between Asia and other continents will in the immediate future increase enormously," and "when the Chinese harbours are provided with deep-water quays, the handling of cargo will be done by mechanical appliances in spite of labour conditions." Again, all of us in China who know Europe and America agree with the words in the report : "It is to be expected that the world will no longer fail to obtain the co-operation of China in the deve-

lopment of intercourse on the oceans." Tientsin and other ports of China have schemes for improvement. At the least, all of this means modern methods of electric lighting for the wharves and the go-downs. In reality it will mean all sorts of electrical appliances for the handling of cargo, and the thousands of other ways of using electricity.

Quietly and almost unobtrusively about 100,000 Chinese "over there" were doing spade work, and at the critical moment all of them in Picardy seized the rifles handed out to them by the American engineers. Then they fought like men. They take as kindly and as quickly to engineering appliances as to the rifle. They cannot yet produce the industrial leaders; the writer very much doubts that they will do so in this generation. But they do want to see their country developed, and they would rather that Anglo-Saxons did it than any other race.

The phenomenal growth of the Japanese trade during the war shows what could have been done by British manufacturers in the Far East if they could have sent out supplies. The figures available do not include the whole of the period of the war. But the authorised capital of the electric enterprises in Japan increased from 500 million yen (say £54,000,000) to 644 million yen (say £69,000,000) at the end of 1916. The generating capacity of the companies increased by 200,000 KW. The production of electric bulbs increased from about three millions in 1913 to over seven and a half millions in 1916. But the Chinese do not like Japanese electric bulbs—too many have been shown to be defective. Yet the exports of electric apparatus—nearly all of it to China—went up from one million yen to nearly twelve and a half million yen in three years. British electrical exports to China could have been enormously increased if only the goods could have been delivered.

"It is a fact," said an American leader of industry recently, "that at the present time there is no place where creative genius is more needed, or as much needed, as in the scientific production or utilisation of food." China is essentially an agricultural country. It is unlikely that costly machinery will be used by the small agricultural farmers, but the problem of communications affects electrical manufacturers. The only solution of famine troubles in China involves improved communications. They must be made, and they will be made; light electric railways have not yet been introduced, but there must be plenty of scope for such cheap methods of construction. It is astonishing to see how quickly the Chinese have taken to joy-rides in motor cars and on the local tramways. It is the same in Shanghai.

Nobody doubts that there will be a rapid development of the vast railway programme for China which was hung up by the war. That will be taken in hand at once. We shall be disappointed in Hong-Kong if, in three or four years' time, the railway from Canton to Hankow is not completed. That will enable us to go all the way by rail from this colony to Calais.

The two big trade centres of China are Shanghai and Hong-Kong. The former has a magnificent electricity supply system, with many of the details of which readers of this journal are acquainted. Hong-Kong will soon have a thoroughly up-to-date generating station, and it is the intention of the management to push extensions forward as rapidly as possible.

The directors of the supply company for the city of Canton recently sent orders to America for quite an extensive plant of turbo-alternators. But what a chance Canton presents to the far-sighted engineer who knows anything at all about electricity! City of a million without a wheeled vehicle, almost without a wheel at all, it is a hive of industry carried on as it has been done for centuries. The only difference is the kerosene lamp in some shops and electric lamps in the gay restaurants and other places lucky enough to be connected to the limited supply system. But the management has been very unenterprising, and Canton carries about one-tenth of the load that a real "live" Britisher with capable Chinese assistants could connect to the generating station. Moreover, Canton is like the hub of a wheel, all around the rim of which are many towns and villages—what a chance for a distribution system! History tells us that for a year or so the British administered Canton. At present the place is in political chaos—if only the British could establish law and order there, and introduce electrical machinery and goods! The Chinese would very soon buy them and apply modern scientific methods to their own particular industries. They very quickly follow an example. There is no merchant in the world to beat the species of Canton. Throughout the Straits Settlements, the Federated Malay States, you will find Cantonese owners of the mines and the rubber estates. The Cantonese has the business acumen of the Jew, the industry of the ant, and the tenacity for trade of the Englishman. Canton has been always the centre of political unrest in China since Good Master Weddell, nearly 300 years ago, first planted the British flag on the old forts at the mouth of the Canton river. He went out there to trade; thousands of Britons have followed in his footsteps. But our Government must give us moral support.

The changes in China during the last 10 years have been in the intellectual realm. They are the forerunners of material changes. A few weeks ago there was a conference of Cantonese merchants at Shanghai concerning the establishment of a hospital on Western lines. One of the old literati—the type still exists in Great Britain—wanted to stop the wheels of progress; he began to quote the Chinese classics. The Cantonese merchants so far forgot their usual suavity as to shout him down. They subscribed money for the Western hospital. The Republic may not have been a success in the way of producing good government, but it has broken down the intellectual bondage of the Chinese.

Before the war the Chinese merchants talked about modern science, and they sent their sons to Europe and America to learn all about it. The struggle has made the name of Great Britain much more respected in China. "Nothing succeeds like success" in China. The millions of pounds spent by the Germans in the Far East have been wasted. Let the British electrical manufacturers spend a few thousands and come into the greatest market that is to be found in any part of the world. Then will the romances of the early pioneers—Jardine, Dents, Mathesons, and the others—who came out to Canton exactly 100 years ago, be repeated. These men worked in anticipation of the expiration of the old East India Company's monopoly; they made fortunes for themselves and their heirs. The engineering manufacturers of Great Britain can with the national pluck, energy, and prestige—the latter is to-day at its highest—reap in the fields made fallow by those early pioneers. Let them work in readiness for the amazing industrial revolution which is even now commencing in China. There is room for all competitors—the field is so vast.

Transmutation of Metals.—The Spanish daily Press of January 14th makes mention of an "important discovery." A medical student, of Alicante, Don Germán Botella Pérez, has discovered an electrical process by which mercury can be decomposed, leaving a residue of gold and a certain amount of radium. The discoverer, "a modest youth of 24 years," is very reticent on the subject, and will give no details until he has read a paper before the Alicante Academy of Sciences. In the meantime, he is busy selling gold to the jewellers of the city. The inventor's reticence is not surprising.

THE ELECTRIFICATION OF SEED.

BY CHAS. MERCIER, M.D., F.R.C.P.

MANY efforts, extending over many years, have been made to stimulate the growth of plants by means of electricity. Forty years ago, Sir W. Siemens conducted experiments for this purpose, and at many places on the Continent experiments extending over many years, and of the most varied character, were made during the last century. Both static and dynamic electricity have been applied to this purpose. Among the early experiments were attempts to capture the natural electricity of the air by means of a kind of lightning conductor, and direct it upon or into the crops. The next step was to generate static electricity to reinforce or replace that derived from the air, and to direct it upon the crops. Another method was to bury plates of zinc and copper in the ground, and to connect them by metallic conductors. Then, when dynamic electricity came to be generated in large quantities and to be generally employed, it was applied in various ways to growing crops, usually in such a way that the crop might be placed in an electric field. Wire netting or a system of parallel wires was suspended over the growing crops, and kept in connection with an active dynamo, and experiments on this plan are still in progress, and are the subject of reports in recent issues of the *Journal* of the Board of Agriculture.

All these methods obtained a measure of practical success in accelerating the growth of the plants subjected to the electric influence, or in increasing the vigour of their growth, or the amount of their yield, and in many instances the effect was remarkable; in some it was astonishing; but in all, the methods were attended by practical inconveniences which have prevented the adoption of the methods except upon an experimental scale. In some, the expense is prohibitive. In all, complicated apparatus is necessary; and in most, this apparatus is so connected with the ground as to interfere with agricultural and horticultural operations, and to necessitate its removal and re-erection at least annually, and usually at more frequent intervals. In addition, they all require some supervision, many of them require skilled supervision, during the whole time the crops are growing; and this is not only inconvenient, but also is a heavy item of expense. For these reasons none of the systems of applying electricity to growing crops has been used commercially, or upon any considerable scale. Some of them are restricted to greenhouse use, a few have extended to the garden, and one or two have been employed on small acreages of agricultural land; but none has been taken up as a part of regular farming routine by a farmer working on a commercial scale for profit. In other words, though they may be, and some of them are, practical successes, between practical success and commercial success there is a great gulf fixed; and up to now this gulf has proved impassable to every system of electrifying growing crops.

In these circumstances it occurred to a practical electrician who had already made an important invention in electricity, and who lives in an exclusively agricultural district of a predominantly agricultural county, to try whether the electrification of seed before it is sown would not yield results similar to those that follow the electrification of the growing crops. If it should do so, it would obtain these advantages free from the disadvantages that have hitherto proved fatal to the adoption of electricity on a commercial scale for the stimulation of plant growth.

The experiments were made at first tentatively in a few pots. The result was so encouraging that they were repeated on a plot of garden ground. Again the experiment was unmistakably successful, and a neighbouring farmer was prevailed upon to sow electrified seed on a few acres of a field in which other seed from the same bulk, but unelectrified, occupied the larger portion. The farmer had the usual farmer's distrust of innovation, and utter disbelief in everything emanating from an amateur or from a "scientific" source. He knew the thing would fail, and since he has found salvation he has confessed that he intended it to fail, and worked to that end. But lo! it was successful. The electrified seed produced a distinctly, and even a strikingly, better crop than the rest of the field. Some of the farmer's prejudice was removed. He consented to try the electrified seed again, though he was strongly of opinion that its success was only a fluke. However, it was successful again, and his scepticism began to crumble in earnest. Now he sows with electrified seed the whole of his arable, extending to some 300 acres, reserving only a small plot in each field for comparison.

Meanwhile, the news had spread. Neighbouring farmers became curious, and desirous to try the treated seed. The first farmer therefore installed a plant for electrifying not only his own seed corn, but that of his neighbours also, and this plant has ever since been fully employed.

The inventor, Mr. H. E. Fry, of Godmanstone, near Dorchester, has all the caution as well as the enthusiasm of the scientific experimentalist. He was in no hurry to see his system adopted. He made no effort to spread the knowledge of it until he had proved incontestably and beyond the possibility of doubt that it could be relied upon to give an increase in the yield of the seed, and for a long time there was such a want of uniformity in the results that, in spite of striking successes, he hesitated to recommend it for general adoption. In time, however, and by prolonged and patient experimentation, the causes of this lack of uniformity gradually became apparent. It was found that different kinds of seed require very different lengths of treatment to produce in them the best effect. It was found that certain subsidiary operations have a great effect upon the results, and that unless these subsidiary operations are properly conducted, the result may be disastrous; but it was found that if these things are all attended to, and the operation is in every respect properly conducted, an increase in the resulting crop is a certainty.

The process is as simple as possible. It consists merely in passing a weak current of electricity through the seed for a certain length of time. In order to render the seed permeable by such a current, the seed must be steeped in a conducting solution, a weak solution of some metallic salt. As it cannot be sown when it is wet, and as, moreover, if left wet the seed would be apt to heat, to become mildewed, to sprout, and to suffer in other ways, it is necessary to dry it, and the drying is a very important part of the process, for in nearly every case in which the result has been unsuccessful, the ill success has been due to faulty drying. The seed has been dried too much or too little, at too high a temperature, or not soon enough, or there has been some other fault in the drying. The electrification is scarcely ever at fault. Hitherto, the seed has been dried in a malt kiln, which requires the services of a skilled maltster, and during the war the services of such a man were not always to be had; but a new method of drying is now in course of evolution, and if this answers expectation, no more failures from faulty drying will occur.

The electricity may be generated by a dynamo, or may be taken from a town supply. In any case, the current required is but little, varying, of course, with the quantity of seed under treatment. For purely experimental purposes, in which packets of small seeds, such as those of tobacco or tomato are treated one at a time, a pint jar and an accumulator are sufficient. For a tank of a capacity of

100 sacks of corn, the amount of current required is relatively large, but it is not absolutely large as amounts of electricity are now estimated. The sojourn of the seed in the electrifying tank varies, according to the kind of seed, from an hour to seven or more hours.

The effect of electrification on the crop that grows from the electrified seed is very important. There is an increase in the yield of grain, varying from 4 bushels to 20 or more bushels per acre, or from a sack to 5 sacks or more, or from 10 per cent. to 60 per cent. or more. In addition the straw is increased both in length and strength. This is very important, for it enables the crop to stand up against storms that lay flat the adjacent crop from unelectrified seed.

Up to the present, the process has been worked out only for wheat, oats, and barley, but equally good results have been obtained with many other seeds—turnip, mangel, cabbage, tomato, tobacco, cotton, and many more. When the proper duration and strength of current, the proper strength of solution of the proper salt, and so forth, have been determined in each case, the treatment of these seeds also will be placed on a commercial footing. Evidently, there is a great future before the electrification of seed.

PLANNING A WORKS RESEARCH ORGANISATION.

By A. P. M. FLEMING, O.B.E., M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

No plans for the future development of industry are now considered complete unless they provide for scientific research, and in no industry is there such scope for research as in the highly technical electrical industry. During the past few years there has been a great deal of research directly controlled by or associated with industry. An increasing amount of work is being done in universities and technical colleges, and in various other laboratories and organisations. In a national sense, the Department of Scientific and Industrial Research is endeavouring to develop co-operative research in various industries, with the initial assistance of Government funds. In many instances it is advisable for firms to establish research organisations in connection with their own factories.

The purpose of this paper is primarily to outline the scope of such a research organisation, the features which underlie its effective planning, its requirements with respect to staff; the design of the buildings and the initial outlay and cost of maintenance of the organisation.

It is necessary to draw a clear distinction between research work in pure science and industrial research. Both are essential to industrial progress. The justification for undertaking research in pure science in a research laboratory associated with an industrial concern lies in the almost inevitable industrial applications which follow rapidly in the wake of a new scientific discovery. Much of this work, however, must be carried on by scientists working in private, university, co-operative, or national laboratories.

Research laboratories partly or wholly supported by the industrial firms may be broadly classified according to the particular interests they are intended to serve, as for example:—

1. Industrial research laboratories self-contained and serving one particular works.

2. Central industrial laboratories each forming the scientific focus of an industrial organisation comprising several works, often in different industries, and linked up by control laboratories at the individual works.

3. Laboratories planned to serve a wide range of interests in various industries in connection with isolated problems.

4. Laboratories designed to serve the needs of one particular industry working on a co-operative basis. The laboratories of the proposed research associations in Great Britain would fall into this class.

5. State laboratories carrying out researches occasionally of an industrial character, but not necessarily for any particular firm, such as the National Physical Laboratory, the Bureau of Standards, U.S.A., and various university laboratories.

Most firms find it expedient to combine necessary routine testing with research work, at any rate in the initial stages of development. Both routine testing and research have much in common.

The functions of a works research organisation may be classified thus:—

1. Testing of raw material supplies and the establishment of a suitable technical basis for purchasing.

2. Production of new materials or substitutes for those already in use.

3. Investigation of difficulties arising in the manufacturing organisation.

4. Investigations necessary for controlling and maintaining technical processes in manufacture.

5. Development of new and improved processes and their establishment on a manufacturing scale.

6. Development of methods for the treatment of factory waste and scrap for by-products.

7. Investigation of fundamental data for designing new apparatus.

8. Development, improvement, and standardisation of tools, appliances, and methods of testing.

9. Investigations of operating troubles and service for customers.

10. Investigations for the information of financiers of the possibilities of new scientific projects.

11. Physiological and psychological investigations relating to vocational selection and for determining the most efficient means of employing human services.

12. Research in pure science.

The character of the industry determines mainly the scope and nature of the work to be done, and, consequently, the number of sections of the laboratory. To illustrate these divisions the author, in the original paper, discusses special lines of research. Reference is made to work involved in the improvement of technical progress, and the application of physchological and physiological tests. The prevention of the repetition of work done elsewhere is emphasised; collection of such data must not be undertaken promiscuously by the research workers themselves, but by a small, specially trained staff. All information to be centred in the Research Library. A systematic record of all costs, stores, breakages, and wages is of great importance.

In routine testing for works departments the nature and number of the tests carried out form a series of sections, each having a departmental chief responsible to the director, and a staff of senior and junior assistants. There should be regular conferences of the departmental chiefs and research workers to prevent overlapping and duplication of work. The closest co-operation should exist between the staff engaged more specifically in research and those engaged in routine work, and especially also between the whole of the laboratory staff and the works staff.

The most important feature of a research organisation is that of the staff. There has been a lack of technically-trained young men who are able to apply the results of scientific research in industry. For a considerable time to come, the supply of men will be totally insufficient for the needs of industry. It is an error to suppose that industrial research cannot be carried on without men of genius. Such a type, indeed, is generally not at ease in an industrial works where research can be reduced to the character of a business, where procedure can be organised on systematic lines. With the exception of those actually engaged in directing research, the staff should comprise comparatively young men and women capable of distinguishing cause from effect, able to observe keenly, and possessing sound technical training, preferably of university standard in the faculty pertaining to the industry they propose to enter, followed by some practical experience.

In addition to serving as a nursery for research workers, the laboratories should undertake part of the training of those young men who in a large organisation are being trained for higher industrial positions. The research department should work in close contact with the educational portion of the organisation now becoming an essential feature in industrial concerns. Every possible step should be taken to reveal latent talent, and to provide opportunities for acquisition of the necessary education and experience.

The staff of an industrial research organisation, comprising sections as indicated above, will generally include a director, sectional heads, senior and junior assistants, with possibly a number of individual research men responsible to the director. The director must appreciate the possibilities of applying new knowledge to industry to commercial advantage, and be able efficiently to direct specialised research workers, avoiding aimless research having no ultilitarian objective. Besides a wide scientific knowledge he must have in addition considerable organising capacity, commercial instinct, and a thorough knowledge of the manufacturing processes of the industry. He must have sufficient breadth of view to be willing to employ expert assistance whenever occasion for this arises. The sectional heads will, in general, be men of high scientific standing. These, and the senior staff, should be men of university education and training.

In designing laboratory buildings the advice of a competent architect is necessary in all matters of a purely architectural character. These, however, should be subservient to the considerations which decide some forms of construction and some arrangements most appropriate to the laboratory as such. The research laboratories should be contained in a building separate from but centrally situated in relation to the works departments. The size of the laboratory will be determined mainly by the number and character of the sections, the volume of work, size of staff, margin allowed for extension, and the amount of money available for initial outlay and maintenance.

The importance of providing a liberal amount of space initially to permit of extension without undue cost or inconvenience is emphasised. The type of building may be determined by the gross floor area needed, also possibility of extension must be borne in mind. Factors affecting the selection of a fabric are elimination of vibration, lighting, fire risk, &c. A flat roof readily lends itself to any partition of the building into sections; it offers no exposed parts to corrosion, and hence both the first cost and maintenance cost are low; it secures the most equable temperature under external fluctuations, and it is the best form for artificial lighting. Further, a flat roof can be utilised as a proving ground, where weathering properties of materials have to be tested.

Constant use of delicate instruments demands freedom from vibration, and its reduction depends to a large extent upon the choice of fabric. A reinforced concrete skeleton and flooring for two-story and multi-story buildings gives the least response to disturbing forces. All buildings, however, vibrate to some extent, and precautions taken against vibration depend on internal construction.

The problem is twofold: (1) the building has to be screened from the disturbing forces set up by its own contained machinery; (2) special apparatus may require to be screened from disturbances communicated to the building from outside. The former necessitates the isolation of unbalanced machinery in reference to the main structure. For this purpose the machinery may be housed away from the main building or situated on the ground floor or basement, preferably supported by piers built from the ground and separate from the rest of the building. In some cases it may be necessary to avoid the use of line shafting. The screening of apparatus may only require the provision of rigid tables which will not vibrate themselves, and which can be placed in positions where the vibration taken up from the building will not be serious. In this case a table top in reinforced concrete, slate, marble or like material supported from the floor by substantial piers in brick or concrete forms a satisfactory arrangement. An example of special supports is afforded by the laboratories of Andre Citroen et Cie. Here special balances, photo-microscopic and electro-magnetic apparatus are situated on the first floor, and carried on marble tables. A typical table has four india-rubber feet which rests upon the tops of two piers rising through the basement from a common foundation of concrete and brick. Each pier consists of sections in brick, concrete, and compressed cork, the latter being capped by a plate on which the india-rubber feet of the table rest. Much may be done to remove vibration troubles by providing apparatus with flexible supports loaded with a sufficient mass.

Special treatment of the problem of natural lighting is required in planning a research building, on account of the close and accurate observation which is necessary. It is important to appreciate the relative values of the intensity of illumination in the vertical and horizontal planes required for different kinds of work.

CAPITAL OUTLAY AND MAINTENANCE COSTS FOR LABORATORIES.

	6,000 sq. ft. Type 1. Single story.	12,000 sq. ft. Type 2a. Single story.	12,000 sq. ft. Type 2b. Single story.	52,000 sq. ft. Type 3. Multi-story.
Building	£4,000	£7,640	£6,930	£28,500
Furniture	1,050	2,100	2,100	9,100
Apparatus	3,900	7,800	7,800	33,800
Total capital outlay, excluding land... ...	8,950	17,540	16,830	71,400
Total annual maintenance, including salaries ...	8,700	17,400	17,400	75,500

From pre-war costs considered under the following heads: (*a*) building; (*b*) furniture; (*c*) apparatus and equipment; (*d*) maintenance, including salaries, the author arrives at the collected data shown in the above table. Excluding the cost of land, the cost of the building for the fabric assumed is slightly less than half the total capital outlay. The normal annual maintenance cost is about equal to the capital outlay. These relations, confirmed by American data, show that the cost of the buildings is of secondary importance.

DISCUSSION IN LONDON.

Mr. C. C. PATERSON, in opening the discussion, said that the paper described foreign organisations, which he understood it was intended to do, but in this country they were not altogether without similar institutions. In his opinion the heads of such organisations should be very highly qualified men; they should confine themselves to actual research work, and not have to bother themselves with the management or administration of the laboratories. The author had not made it clear as to the scope of work that would be permitted; the speaker thought it should not be limited to industrial research, but should deviate therefrom when profitable results were likely to accrue. The working hours of such organisations could not be set as in a works; a man might be in the middle of an important experiment which, if interrupted, would have to be commenced all over again. Further, research workers must be free to attend lectures, discussions, &c., even if they took place in ordinary working hours, or at some distance away; this was important, it was essential to have freedom. The holiday question was also an important one. Research work, if carried out in the manner it should be, imposed a considerable strain on the worker, and after 12 months of such work it was quite unreasonable to expect that a couple of weeks' holiday was sufficient to enable the man to recuperate. The speaker did not agree that multiple-story buildings would have to be adopted where 12,000 ft. or over of superficial area was required. He preferred single-storey buildings which could be more easily extended, and better lighting, &c., could also be obtained by such. The efficiency of a research organisation would greatly depend on the workshop facilities available, by which test specimens could be prepared and special machines and apparatus built. He thought that 10 to 15 per cent. of the total cost of such an organisation should be expended on the provision of an adequately equipped workshop. An up-to-date and well-stocked library was also an essential item, and it should be centrally situated where it would be accessible to all. It was a mistake to place the library at the top of the building; very often it was thought to be too much trouble to go a distance every time an item required to be looked up.

Dr. E. P. HEDLEY thought that more money should be spent in this country on research, and that there were many lessons to be learned from the U.S.A. In any such organisation team work was an essential feature, and it would be found to be more economical than individual work. There was a danger that such organisations would be used as training grounds for men who would be later on transferred to the works. This should be strictly guarded against as success would never be attained if men were moved to another department as soon as they became efficient in a particular line of work. It was important that research workers should be paid adequate salaries, the figure mentioned in the paper would never attract suitable men (to which the author replied that the figure given was only meant to illustrate the proportions into which the various items of expenditure were divided. In practice he would expect such men to be on a par with university professors). Dr. Hedley said that in his opinion even university professors were by no means adequately paid. The payment of a bonus for individual work was an easy matter, but for an idea developed and worked up by a number of men it would be extremely difficult to apply the system, therefore team work was essential. The bonus should be pair to the whole, and divided amongst the individuals according to their salaries.

SIR ROBERT A. HADFIELD, F.R.S., said that practical men would confirm much of what had been said. Not so little had been done in this country as was thought by some. This war had shown that when they put their mind on a thing they got there in spite of all obstacles. "They might be mean, but they got there all the same." Sir Robert then described his visit some years ago to Krupp's works at Essen, £180,000 had been spent on the research organisation there. He was shown all over it, from top to bottom, and it was a wonderful place. It was a curious fact that everything was fully explained to him, and all questions he had put were fully answered. He had no idea why that had been done. When he left the works a lengthy, illustrated catalogue, in which every room of the research department was described, was presented to him. He had had it translated, and if it would be of any use to the institution he would have pleasure in putting the translation at its disposal. Sir Robert exhibited an interesting model of the research building at his works, and explained its principal features. He thought all research workers' salaries should be on a generous scale, and, in conclusion, he paid tribute to the "noble band of men" who had done their bit in the way of research in this country during the war.

DR. C. C. GARRARD said that the head of such an organisation should strive to get all routine work done as cheaply as possible. A research department was similar to the costing department; the latter looked after the financial side, while the former should do the same regarding labour and materials. It should be looked upon as a sort of development department, and provide suitable labour and materials so that production in the works could be made as cheap as possible. With regard to the buildings described in the paper, he thought they were much too costly; in his opinion suitable concrete buildings could be erected at a cost no higher than 8d. per ft.

Mr. E. SACHS, speaking from an architect's point of view, commended the buildings described in the paper. Fire risk should not be dismissed lightly; buildings ought to be subdivided much more than they were. It was bad practice to have numerous long corridors by which fires could be communicated from one part of a building to another. There was much to be said in favour of concrete buildings in respect of freedom from fire risk and vibration. In all good modern buildings it was essential to provide ducts through which all piping, wiring, &c., could be carried. He was also in favour of the openwork type of furniture, as there was less fire risk. In his opinion not much would result from secretive work; team work was undoubtedly the best. Freedom of the worker was essential; such an organisation would never be a success unless freedom as to working hours was allowed. Personally, he was in favour of ordinary roofs—not flat ones—but if the latter were provided, they should be double, with an air space between.

Mr. H. ROTTENBURG thought that the most important division of any research department was its library. Most libraries to-day were practically useless; good libraries should be able to provide, when asked, all the latest and most up-to-date information on any subject, no matter in what part of the world that information originated. The library should also contain complete references, and an index to all research work carried out. This would avoid duplication, as an investigator, before commencing new work, would be able to see without waste of time, exactly how far the matter had been carried in the past, and just what had gone before. Of course such a library as he had in mind could not be provided for each separate works, but one central depot, where all who wished could apply for information, would soon prove its value. Some firms might perhaps object to information being distributed broadcast in such fashion, but there was much which at present was hidden away that could be made public with beneficial results, and, of course, certain things need not be gone into in detail. A further point was that many special and costly machines and apparatus made for research purposes, after being used, was, he was sorry to say, put on one side, and left to rust away into oblivion. Now, if an inventory of all such apparatus, with full particulars, was kept at the central library, other experimenters could, instead of building fresh apparatus of their own, obtain machines which with slight alteration might be used over again. In this way the costs of experiments could be largely reduced. Co-operative work was very essential in his opinion. In support of this contention he instanced what had happened in Russia. That was a hugh co-operative effort on the part of the people to bring about a certain thing. What had been the result? Certainly not what was expected, instead, two individuals had come out on top. The same thing was likely to result from co-operative research; individualism would certainly not be killed.

DR. W. ROSENHAIN thought that research work and production should be kept entirely separate and away from one another; routine testing was part of production, and should, therefore, not be included in the duties of the research department. The laboratories should not be at or anywhere near the works, if they were they would be dominated by the influence of the latter, whose sole aim was production. The two things were entirely different, and should be kept apart. He did not favour the buildings described in the paper; such buildings ought to be designed by the men who were going to work in them, and not by architects. He knew of certain buildings in Germany, quite perfect from the architect's point of view, which when completed were discovered to be quite unsuited to the work it was intended to carry out in them. He entirely disagreed with the author's statement that research could be reduced to a business, also working hours could not be governed. A great deal depended on leadership, the man who leads the work was the one who made it a success or otherwise.

A speaker, whose name was missed, gave some details, and exhibited plans of the research organisation for which he had been responsible. He agreed that all routine testing should be excluded from the research department, and took exception to the author's statement that "much could be done with the ordinary man." Surely a man possessing qualities and qualifications such as the author had enumerated was not an ordinary man? The right type of men were very difficult to find, especially now, when so many of the best had been lost, but when such were found they should be placed in the right environments and allowed to go right ahead with their work, and not be bothered with minor details. All depended on what sort of a start was made. Regarding the financial side, the amount that was spent annually on research work would be known; it would also be known on what it was spent, it therefore did not matter how it was spent. If the heads of such organisations were required to furnish detailed accounts of all expenditure they would have an intolerable state of affairs. They would have some of the finest brains in the country occupied with matters of £ s. d. instead of getting on with the legitimate work.

Prof. C. R. DARLING inquired as to the percentage of the turnover that it was proposed to spend on research. If some idea of this were given, small firms would be able to co-operate. Large firms who could afford to set up such organisation individually were, after all, not in the majority. He would also like to know where it was proposed to get the staffs that would be required for such research organisations. Now that so many of our best had been lost, those who were left would immediately be absorbed for production where there was great need of them. In his opinion the scarcity of the right type of men would be the greatest obstacle to the scheme; it was a problem where these men where going to be obtained, it would be some time before the output would meet with the demand. He did not agree that the recruiting ground for such men should be restricted to the Universities, that would considerably narrow the ground. All good technical colleges should be included; some of the best men, quite equal to university men, were turned out from these colleges. It should be remembered that Faraday and others were not university men.

Owing to the lateness of the hour, other members' contributions as well as the author's reply to the discussion were reserved to be published later in the *Journal* of the Institution.

DISCUSSION AT NEWCASTLE-UPON-TYNE.

Mr. A. P. M. FLEMING, O.B.E., delivered his lecture before the North-Eastern Centre on January 15th. Mr. A. P. PYNE, chairman, in opening the discussion, said that the question of research was a vital one to this country. Those who knew what was being done in Germany and America knew also how far we were behind in this country. It was true that during the war we had picked up some leeway, but we had a long way to go before we reached the position that we ought to occupy. Small firms were in a worse position than were the large ones, for they could not hope to run such organisations as Mr. Fleming had referred to, but, on the other hand, there was that need for research carried out on general lines.

Sir GEORGE HADCOCK (Armstrong, Whitworth & Co., Ltd.) said the lecture and discussion were very opportune, for the air was full of schemes of reorganisation, and, naturally, industrial research formed a large part of that reorganisation. Probably few firms could run such buildings as had been shown; that should not discourage them, because those buildings, although desirable, were not necessary. At Elswick they had done a great deal with a building of much more modest dimensions, and with very little apparatus. There were many operations that could be carried out in the regular course of industry. Research, however carried out, might be divided roughly into two sections—investigation made of a purely scientific character, which was done at the National Physical Laboratory, and that which referred to the improvement of technical details, construction, &c. He thought the right policy would be to make as much as they could, and that was the policy that they ought to grasp and take advantage of. Referring to co-operative research, Sir George said the system was an excellent one, but it had the drawback that it meant that each manufacturer must disclose all his trade secrets. That might be desirable for the country at large, but if they had co-operation they would not have any competition. Shops were becoming more and more specialised, that was necessary to enable them to compete; they must specialise. As a result, promotion in the executive branch was naturally confined largely to shop experience, with high technical training, but there were few with any scientific training. If research workers could be sure of promotion, university graduates would look more favourably on the work. As to the buildings, he thought Mr. Fleming had gone too far. To have them carried out on a co-operative scheme would not be so bad, but for individual firms the system would be out of all question.

Dr. MICHIE had little to criticise, it seemed to him that the scheme was very complete. He was glad to see that the chemical section was placed first. He was much interested to notice the psychological section, and he wondered what would happen if, in these democratic days, some of the subordinates thought that those above should be examined. The provisions to eliminate vibration were very good; it was a matter that was not generally given the attention that it ought to have. Also the question of illumination had, in the past, been greatly neglected.

Mr. H. W. CLOTHIER could confirm from the small works point of view that a great deal of research work was being, and always had been done by manufacturers without elaborate provision. He could very well conceive that they could go too far, and soon find themselves with a "white elephant." In a small switchgear supply works they had their routine testing apparatus for all electrical tests. He found that the General Electric Co., of America, was testing up to 12,000 amperes, 200,000 volts. Some years ago he took part in some tests at 12,000 amperes, and they had routine tests at 8,000 and 10,000 amperes, although not at 200,000 volts. Very shortly, however, they would be in a position to carry out 250,000 or even 300,000-volt tests. Although they had not those great buildings they were able to produce in England apparatus which, in many cases, excelled that which came from other countries. He thought there was also great danger of working too much in isolated compartments, and one would sometimes get better results if the research work were carried out in ordinary manufacturing works; the work was thus done in a more flexible way. The English method, he thought, encouraged better individual initiative. As to the question of publicity, he was of opinion that the Americans used their research establishments as advertising media. There were arguments for a co-operative research establishment; for instance, they wanted the breaking capacity of a switch, and needed a million K.V.A. to test it. Of course no single firm could contemplate such a thing as that.

Mr. COOKE was glad that so much attention had been given to the building. He had been associated with research work for many years, and, generally, found that special provision was made for special work, instead of organising the department for research in general. It was an important point, nothing cramped research work like want of room. He did not think that a firm would be justified in following Mr. Fleming's elaborate classification of subjects of research as the basis of such an establishment, nor did he favour an excessive amount of plant which would probably soon become obsolete. His opinion differed also from Mr. Fleming's as to the costing office.

Mr. A. FAWSSETT said that individual organisations would lead to great duplication of work, and it seemed to him that it would be better if there were a central authority which would be impartial in dealing with difficult problems. A co-operative laboratory was much needed on the north-east

coast, to deal with the more difficult and unusual problems which required so much plant that they could not expect one firm to undertake it.

Mr. FLEMING, replying to the discussion, said that large buildings and equipment might be unnecessary, but the work had to be done somewhere, and a time would arise when it would become more economical to set aside a special staff, and not to hamper the works department. He did not agree with the suggestion that if some of the trade "secrets" became common property competition would cease; for his part, he thought that competition would then really commence and become more intense.

THE NAVIGATIONAL MAGNETIC COMPASS CONSIDERED AS AN INSTRUMENT OF PRECISION.*

BY M. B. FIELD, O.B.E., M.INST.C.E., M.I.E.E.

(*Concluded from p.* 112.)

The lecturer next pointed out the effect of magnetic dissymmetry of a card. If one of the needles of a two-needle card were materially weaker than the other, no deviation would be noticed when testing the compass in the usual way in a uniform magnetic field. In such a field both needles, no matter what their strengths might be, would tend to point along the lines of force, and the card would point "true." When, however, the compass was placed in a non-uniform field, such as those already illustrated, an effect would arise due to inequality of magnetic strength of the two needles. Dissymmetry of this character could not be detected by the usual tests made in a uniform field.

A further instance of dissymmetry might occur if the magnetisation of either needle was unsymmetric about the central plane of that needle; an illustration of this effect was given by reproducing the iron-filings diagrams of a "bad" permanent magnet (*a*) immediately after magnetisation; (*b*) six weeks after magnetisation (figs. 6a, p. 110). The field of force, which was symmetrical immediately after

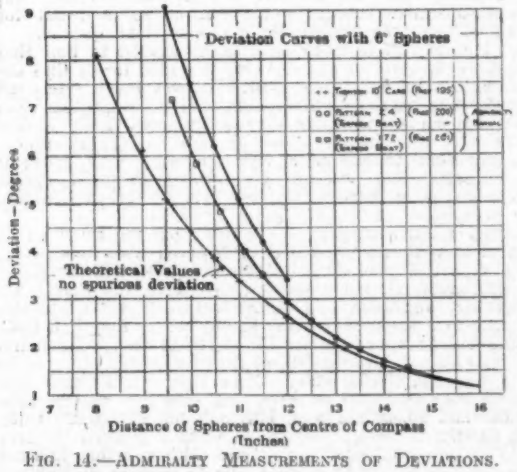

FIG. 14.—ADMIRALTY MEASUREMENTS OF DEVIATIONS.

magnetisation, had become exceedingly unsymmetric during the interval. Apparatus were exhibited by means of which needles might be rapidly tested in the workshop:—

(*a*) For equality of magnetic moment.

(*b*) For symmetry of magnetisation about the central plane of each needle.

The lecturer had intended to speak about the magnetisation of the ship, and how the various correctors performed their functions, but, owing to lack of time, had to conclude with a reference to the effect of employing undesirably great magnetic moments:—

Briefly, we may say that the earth's horizontal force induces magnetism in the ship, which in general produces an east-westerly force at the compass station, and gives rise to deviation. The function of the quadrantal globes is to neutralise this east-westerly force. If the globes be properly proportioned and placed, no deviation of the resultant field, due to the cause under consideration, exists at the centre of the compass. Nevertheless the card does not necessarily point "true"; it depends on the magnetic moment of the needles.

We may readily test this on shore. Take a binnacle with, say, 8½ in. globes set 12 in. from the central axis, and turn it round until the diameter passing through the spheres is in the N.E.-S.W. direction. We can easily calculate that the direction of the resultant field at the centre of the compass is N. 7.3 deg. E., the deviation from the meridian being due to the deflection of the lines of force by the action of the spheres. Further, this deviation of 7.3 deg. east would be the same at whatever part of the earth we might be experimenting—it does not depend on the value of H. The following table represents a series of tests made at Glasgow.

DEVIATION PRODUCED BY 8½-IN. SPHERES 12-IN. FROM VERTICAL AXIS, ON N.E. AND S.W. DIAMETER.

	Reading	Inductive deviation (approx.).
Standard 10-in. dry-card ...	7·3°	—
Standard naval compass ...	10·0°	2·7°
Torpedo boat "	10·0°	2·7°
U.S.A. naval "	11·65°	4·35°
Ritchie... "	18·9°	11·6°
Common steering "	13·2°	5·9°

The only card which takes up the direction of the resultant force is the small-magnetic-moment dry card. The standard naval liquid compass is attracted 2.7 deg. further in the direction of the spheres, and so on. These attractions are due to the magnetism induced in the spheres by the powerful needles, reacting on the needles.

If we were to repeat this test at Singapore, where the value of H is about 2.3 times the value at Glasgow, we should get the same deviations, only in the case of the small-moment card; the others would be different. In fact the third column of the above table shows the portion of the deviation, the amount of which depends on geographical position. The quadrantal deviation produced by the iron work of the ship does not depend on geographical position, but the amount of compensation provided by the spheres does depend on geographical position, if the needles are strong enough to produce sensible magnetisation of the spheres.

The excellent manual published by the Admiralty on the deviation of the compass gives tables setting out the actual observed deviations of different compasses in the presence of globes of different sizes, and situated at different distances on a quadrantal diameter. A formula is also given by which we may calculate the deviation of the resultant force due to the globes. Fig. 14 shows the Admiralty measurements when using 6 in. spheres. The observations for the "Thomson" (dry) card lie on the theoretical curve, while those of the naval liquid types all lie above. The difference is the amount of the attraction towards the globes, caused by the strong magnetic moments necessarily involved in the liquid compass.

* Abstract of lecture delivered before the INSTITUTION OF ELECTRICAL ENGINEERS, London, January 9th, 1919.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

The following is a further list of contributions received in response to the appeal made by Mr. Hunter:—

	£	s.	d.		£	s.	d.
A. Cohn	2	2	0	M. McCulloch & Co. ...	1	1	0
Anon.	1	1	0	Credenda Conduits Co., Ltd.	2	2	0
A. Warden & Co.	1	1	0	White, Jacoby & Co., Ltd.	1	1	0
J. Wilkins & Co.	10	6		Maxim Lp. Works, Ltd.	2	2	0
J. Shepherd	1	1	0	J. F. Poynter	1	1	0
C. Jermyn Ford	5	5	0	Geo. Rice, Ltd.	10	10	0
Acme Elec. Manfg. Co. ...	1	1	0	County of London E.S. Co., Ltd.	1	1	0
Sunlight Manfg. Co. Ltd.	2	2	0	S. A. Russell	1	1	0
W. B. Williamson	1	1	0	Baxter & Caunter	2	2	0
B. Handley	1	12	6	John Gray	5	5	0
H. F. A. Kinder	1	1	0	Wholesale Elec. Co., Ltd.	2	2	0
Lamb & Sons	10	0		R. O. Martin	10	0	
J. Oakey & Sons, Ltd. ...	2	2	0	E. E. Lloyd	10	10	0
F. J. Down	5	0	0	A. H. Gilling	1	1	0
Stanford & Co.	10	6		E. Erskine Murray	1	1	0
A. P. Trotter	1	1	0				
Everitt & Co.	5	5	0				
A. T. Morris	10	6					

The contribution of £1 1s. 0d. recorded last week as from Messrs. Marshall, Sons & Co., Ltd., was a personal contribution by Mr. W. V. Waite, of that firm.

Renovation of Discoloured Arc-lamp Globes.—The globes of arc lamps often show considerable discoloration, owing to the action of the actinic rays. Mr. A. Hertz, in the *Electrical World*, says such discoloration can be entirely removed by a careful heat treatment. The globes should be first washed with muriatic acid to remove the iron particles and brown powder that have been spattered on to the glass from the electrodes. They should then be placed in a gas-heated annealing oven, and raised in four or five hours to a temperature of 480 deg. to 540 deg. C., which should be maintained for about one hour. The oven is then allowed to cool off for twelve to fifteen hours, care being taken not to open it until the temperature has fallen to 50 deg. C., as otherwise the globes are liable to crack. After washing the globes with soap and water they are again perfectly clear. The cost of the process per globe, including gas and labour, is given as about 35 cents.

BUSINESS NOTES.

Our Letters from the Forces.—"Lieut., R.E.," writing from France, says:—"I wish to take this opportunity of expressing my most sincere thanks to you for the weekly copy of the ELECTRICAL REVIEW that you have so regularly sent me since the early days of the war. I can assure you that it has been appreciated both by myself and by all my R.E. friends more than mere words can describe, and now that hostilities have ceased, and we are returning to our 'civvy' jobs again, it is to the ELECTRICAL REVIEW that we can trace our present touch with affairs electrical. I wish to express my very great thanks for many happy hours of reading 'out in the wilds.'"

A correspondent who has just returned to his pre-war interests in electricity supply writes:—"I am probably only one of a large number who have benefited from and enjoyed your free weekly gift, but I am certain your kind action in continuing the supply over such a period will not be forgotten, and the good old REVIEW will be waited for more eagerly than ever on Friday afternoons. In offering to you my very best thanks for your kindness, permit me to wish yourselves and the REVIEW every best wish for the continued good work you are doing in the electrical world."

Export Restrictions Removed.—The *London Gazette* for January 24th contains a further list of export restrictions which have now been removed.

Swedish Electrical Industry.—It is interesting to review the measures taken by the Swedish electrical trades to provide suitable substitutes for materials which were in short supply during the war.

Copper has, to a great extent, been substituted with other metals, first and foremost, steel, iron, and zinc. For transmission steel cables are now used to advantage. Svenska Metalverken (Swedish Metal Works) recently exhibited a large collection of these cables of all kinds. The installation material is generally made of iron and zinc covered with copper or brass. Both the Allmänna Svenska Elektriska Aktiebolaget (Swedish General Electric Co.) and Böhlmarks Lamp Factory are making installation material of substitutes. The Motor Factory Eck exhibited some samples of oil switches where substitutes for copper have been used to advantage. This development is still more strongly marked in the armature industry. Substitute materials are used with excellent results for cheap as well as expensive lighting apparatus of all kinds. Cheaper lamps are mostly made of iron plate, electrolytically covered with copper or brass; the more expensive lamps are mostly made of zinc and lead well moulded and ornamented, and then covered with pure copper or an alloy thereof.

In commenting recently on the industrial exhibits at the Goteborg Fair, the United States Commercial Agent remarked on the enormous growth in the manufacture of electrical material in Sweden during the war. In a number of articles, especially installation material and casings, foreign competition had the upper hand before the war, and at the prices then prevailing there was no chance for Swedish manufacture. Now Swedish manufacture has taken the market entirely, owing to the increased demand, the disappearance of foreign competition, and the change in prices. "Before the time when foreign competition will again have to be met Swedish manufacturers should be able to meet it. In this connection it may be mentioned that wood-casing, the cheaper as well as the more expensive qualities, has gained more and more ground. Even electrical measuring instruments, which formerly were made only abroad, were exhibited at the Fair, but these are not yet perfect."

Opening for Small Electric Plants in Jamaica.—According to the United States Consul at Kingston, there is a good opening in Jamaica for small electric plants furnishing light for isolated country houses and power for doing the ordinary operations on the farm, such as grinding, pumping water, making butter, &c. Owing to the lack of development of water power, electric current is available only in the larger centres, and there is a good demand throughout the island for individual plants at a moderate price. There is one outfit on the market at present which retails at about £80, and is capable of carrying 20 to 30 18-C.P. lights at 32 volts. The outfit should consist of a kerosene engine and a dynamo mounted on the same shaft, preferably, and a bank of storage batteries. The operation should be as simple and as nearly automatic as possible. Only oil-burning engines should be considered, as gasoline is altogether too expensive at the present time. Attention should be given to the method of packing and shipping, so that the outfit can be set up by an ordinary mechanic.

Brazil.—MARKET FOR TELEGRAPH MATERIAL.—The Brazilian Department of Telegraphs are stated to be desirous of purchasing their material in the United States, instead of in Europe, which hitherto largely supplied their requirements, save for certain wire. United States manufacturers are keenly alive to the possibilities of trade in this direction, and arrangements have been made for samples of the wires, tracings of the posts, arms and pins, together with photographs of iron arms and fittings, wooden arms and fittings, porcelain insulators and pins, and miscellaneous tools, to be on view at the New York office of the United States Bureau of Commerce.

Trading with the Enemy.—The *London Gazette* for January 24th contains further lists of persons and bodies in foreign countries with whom trading is prohibited or whose names have now been removed.

Dissolutions and Liquidations.—LEITNER ELECTRICAL CO., LTD., Maybury, Woking.—Meetings of the creditors and shareholders were held on January 21st, at the Carey Street offices of the Board of Trade, Lincoln's Inn, W.C. The company was formed in September, 1911, to acquire from Mr. Leitner a licence to work automatic electric lighting for trains and vehicles on a royalty basis. A winding-up order was made against the company in October, 1914, under which accounts were lodged showing liabilities £31,566, assets valued at £11,301, and a deficiency of £42,663 as regards contributories. Mr. W. J. Warley, Official Receiver, reported that the meetings had been called at the request of creditors to consider the appointment of a liquidator in the place of Mr. Corfield, who had died. The proofs of debts lodged numbered 127, and amounted to £30,326, but only a small proportion of those had sent in proxies on this occasion. There were eight general proxies, representing £460, and 10 special proxies, representing £15,276, in favour of the appointment of Mr. Albert Cripwell, accountant, Balfour House, Finsbury Pavement, E.C., whilst the general proxy had been sent to the Official Receiver to vote for himself, and two special proxies, representing £7,608, also for the appointment of the Official Receiver, were made out to other persons, who did not appear to be present at the meeting. Mr. Baker (Kenneth Brown, Baker & Co.) said he represented J. Stone & Co., Ltd., creditors for £7,545, and his clients wished the liquidation to be left in the hands of the Official Receiver. Mr. Davis (Greenwood & Batley) wished to move that Mr. Cripwell should fill the post, but it appeared that he had no power to do so, and the chairman announced that although on the figures Mr. Cripwell had a majority, there was no one present qualified to move a resolution for his appointment; consequently, the motion to leave the liquidation in the hands of the Official Receiver carried the day at the creditors' meeting. Then the shareholders had sent in four proxies, representing 8,586 shares and 10,131 votes, for the appointment of Mr. Cripwell, whilst the proxy, representing 11,001 shares and 13,301 votes, declared in favour of the Official Receiver, who thus had a majority at the meeting of shareholders, and would, therefore, hold the office of liquidator.

Asked regarding the prospects of a dividend being paid to the unsecured creditors, the chairman said it depended largely upon the Russian assets. There were some outstanding foreign claims, and there was a sum of 16,000 Romanoff roubles lying at a French bank in London. The present value of those roubles was 3d. each, but if things improved in Russia there might be a higher price forthcoming for them; consequently, they had been held in hand in the hope of an improved market. Then there was a claim to 5,000 roubles against a State railway in Russia, and, having regard to the present condition of things in that country, it might be an exceedingly long time before anything could be settled. There was a further claim to £350 against a German firm, and something might be got from that source, as the assets of that firm were in the hands of the Public Trustee. That comprised the assets, and, of course, no dividend could be declared for the present.

The proceedings then terminated.

MACINTOSH CABLE CO., LTD.—This company is winding up voluntarily, with Mr. A. R. Handley, Tib Lane, Manchester, as liquidator. A provisional agreement was entered into in November for the sale of the undertaking to Messrs. William Rickard, Ltd., and the name of the latter is to be changed to the Macintosh Cable Co., Ltd.

HOME-MORTON & GIBSON, consulting engineers and industrial works designers, 224, St. Vincent Street, Glasgow, and 2, Eldon Street, London, E.C.—Messrs. D. & A. Home-Morton and Mr. G. H. Leckie Gibson have dissolved partnership. Mr. D. Home-Morton will carry on business, under the name of Home-Morton, at the Glasgow address, and attend to the Glasgow debts. Messrs. A. Home-Morton & G. H. Leckie Gibson will carry on the London office as Home-Morton & Gibson, and discharge the London debts.

FERGUSON, PAILIN & CO., LTD.—A circular issued to the creditors by the liquidator of Messrs. Ferguson, Pailin & Co., Ltd., states that in connection with the very considerable extension of their business, the company have found it necessary to reconstruct and to transfer the goodwill and assets of the existing business to a new company, to be called "Ferguson, Pailin, Ltd." This involves, for technical reasons, a voluntary liquidation of Ferguson, Pailin and Co., Ltd., in connection with which it is necessary to convene a formal meeting of creditors. Any liabilities of Ferguson, Pailin and Co., Ltd., which are not discharged before the goodwill transfer to the new company takes place, will be discharged by the new company.

TOURTEL ADDING MACHINE SYNDICATE, LTD.—Meeting of creditors February 3rd, at 2 and 3, Norfolk Street, Strand, W.C. Liquidator, Mr. A. Hartley, 70A, Basinghall Street, E.C.

British Westinghouse &c., Co., Ltd.—The petition for altering the objects of this company is to be heard before Mr. Justice Astbury on February 11th.

A Banker on the Engineering Trade.—In the course of his speech at the annual meeting of the Union Bank of Manchester, Ltd., Lord Rochdale reviewed the position of several trades. He remarked that in the engineering trade great changes had taken place. Most concerns were engaged on the production of war material, but this had generally been discontinued; and many important works were reverting to their ordinary trade and supplementing them with new lines which they felt to be necessary to keep employed the largely extended plant which they had erected in order to increase their war production. The very extensive requirements of the world in general for machinery and allied productions were giving great confidence to this trade; and there was no doubt that the important part which it had played in the past would be enhanced in the future.

Bankruptcy Proceedings.—Alfred Taylor, electrical engineer, 98, Virginia Street, Southport, Lancaster.—This debtor appeared for his public examination on January 20th, at Liverpool, before Mr. Registrar Nield. The debtor said he had been a mining engineer on the Continent of Europe, and for the past 17 years he had devoted himself to perfecting a scheme for the purpose of cheapening the supply of electricity. The scheme was not yet in a position to be protected or patented, but he hoped to complete it soon, when he had no doubt of being in a position to pay all his creditors. He calculated that he had spent on the scheme, including loss of salary since he gave up his position on the Continent, at least £10,000. At present he was living on money received from his family and relations. The examination was adjourned.

C. Mayfield, electrical engineer, Clifton, Bristol.—First meeting, February 5th; public examination, February 28th, at Bristol.

Football.—The match between the Magnet F.C. and the Eastern Telegraph Schools F.C. was played at Hampstead last Saturday, and ended in a victory for the latter club by 2 goals to 0.

Italian Industrial Experts to Visit England.—According to the *Elettricista*, the English Government has invited a Commission of 12 representatives of Italian commerce and industry to inspect the principal industrial and commercial centres of England, with a view to exchanging ideas with English manufacturers, and framing a common programme of action for the mutual advantage of both countries.

The Industrial League.—The second number of the *Industrial League Journal* (December, 6d.) contains contributions from the Right Hon. G. H. Roberts, M.P., the Right Hon. J. H. Clynes, M.P., Mr. G. J. Wardle, M.P., and others. Among further features there is a full report of a conference on "Profit-sharing Schemes," held by the League in June last, when Mr. J. P. Thomas opened the discussion. A contributor to the debate, whose views will interest our readers, is Mr. H. Hirst, of the General Electric Co., Ltd.

German Foreign Trade Activity.—There is accumulating evidence of German trade activity in neutral countries, and also of correspondence direct from Germany to England, endeavouring to open up commercial connections. The *Times* correspondent at the Hague forwards a Berlin telegram, which is published in the *Handelsblad*, stating that the steel syndicate and other iron combinations are authorised to adapt selling prices in Holland and other countries to foreign competition, and thereby gain the business for the German iron market. From the statement it would appear that German competition will be even more severe in the future than hitherto.

The *Board of Trade Journal* says that the British Vice-Consul at Schaffhouse, in Switzerland, writing in mid-December, reported the presence in his district of German commercial travellers, who offered goods at much lower prices than those quoted in Switzerland for the same classes of goods. They also promised delivery in a fortnight. One agent offered a practically unlimited succession of trucks of glassware, earthenware, &c., but it is not known how much of this would have to be brought direct from Germany, and how much had been stored in Switzerland. It is certain, he adds, that large stocks of German make have been kept in Switzerland, waiting to be thrown on the market when prices should reach their zenith. There is a desire to get rid of these stocks now before the Belgian makers become active again. Dutch offers in these lines are numerous, but there is hesitation in fixing date of delivery.

As to German efforts in Belgium, a *Times* correspondent at Coblenz says that the determination of the Germans to re-establish commercial relations with the Entente countries as soon as possible is evident from a letter from the German-Belgian Mutual Association of Düsseldorf to a business man in Coblenz, in which he is asked to become a member of their organisation because of his personal interests in Belgium and Eastern France. "The aims of the Association are to re-establish trade and industrial relations with Belgium, to act as a medium of exchange between German and Belgian firms, and to serve as a centre of information and advice on all questions concerning Belgium and the French districts formerly occupied by German troops."

The F.B.I. and the Excess Profits Tax.—The Chancellor of the Exchequer is to receive a deputation from the Federation of British Industries on the question of the Excess Profits Tax.

The Shorter Hours' Movement.—There are some difficulties in the way of the adoption of the 47-hour working week at Manchester and districts, though it is stated that it has been accepted by the Manchester Corporation. A conference was held last week, at which it was intimated that unless there was a general stepping into line with the rest of the engineering and electrical trades there was likely to be a considerable stoppage of work by employés. Mr. J. Rowan, general secretary to the Electrical Trades Union, considers that federations of employers should exercise a control on those of their members who have bowed to the principle of a 47-hour week grudgingly, and seek to steal it back by absurd regulations.

Representatives from the Electrical Trades Unions waited upon the Bradford Corporation Wages Committee last week, with a view to altering the commencing date of the 47-hours week to January 1st instead of February 1st, as at first decided. The request was granted.

Mr. Arthur S. Murdoch, works manager for the British Electric Plant Co., Ltd., Alloa, writes locally:—"With reference to the agitation being engineered by the less responsible men in the Labour world for a 40-hours' week, may I say that the claim that this shorter week is necessary to absorb the number of men at present unemployed, is entirely controverted by the following facts? For the past eight weeks we have made every effort possible to obtain mechanics for our works. We have advertised constantly in the columns of the *Glasgow Herald*, have been in touch with the Labour Exchanges, and at the end of this period we have not been able to get a single man, and the manager of the local Labour Exchange informs me to-day (January 22nd) that he has applications for a very large number of mechanics on his books from employers, and there are no unemployed men of this description that he can offer either to us or to any other firm. It would, therefore, be interesting for the leaders of this movement to indicate where these 'thousands of unemployed' are."

Patent Restoration.—An Order has been made restoring Patent No. 3,814 of 1912, granted to Thos. Alva Edison, for "Improvements in sound reproducers."

Foreign Trade Department.—The Foreign Trade Department has been transferred from Bridgewater House to the Foreign Office, Downing Street, S.W. 1.

The South African Electrical Market.—The *South African Mining Journal* for December 21st, 1918, contained the following respecting electrical materials:—"Recently an element has been introduced into the retail trade amongst several firms, of cutting prices, hence lamps are being offered freely, per advertisements of various kinds, including extra window dressing. There is a reason for this, that may be personal or otherwise. However, it appears there are heavy stocks of lamps in town, as they have been reduced 3s. a dozen wholesale, and from 3s. to 3s. 6d. each retail. Business is very slack in a general way, and nothing much is expected until the turn of the year."

A Ministry of Commerce.—According to the *Daily Telegraph*, Sir Albert Stanley, President of the Board of Trade, announced at Huddersfield last week that a Ministry of Commerce would shortly be established. Experienced men of practical knowledge had already been invited to join the Board, to bring in a new breath of life. As to excess profits, Mr. Chamberlain had a difficult task to find money, but any impediment to the restoration of trade would be most carefully considered by him. The removal of restrictions was being closely considered. It was the deliberate policy of the Government that controls should be removed as rapidly as possible, but that did not mean that they would look the doors of every department and throw away the key, and leave the industries to carry on as best they could. The blockade of enemy countries must continue until we had secured peace. It was important to traders to know that by the summer there would be as much world's tonnage afloat as before the war. The country might look for a big slump in shipping rates.

Socials.—The Supply Department of the British Westinghouse Electric and Manufacturing Co., Ltd., Long Millgate, Manchester, held their annual smoking concert at the Wellington Hotel, Manchester, on Friday evening, the 24th inst. Mr. J. Gibson, manager of the department, was in the chair, with Mr. G. Ellam, assistant manager, as vice-chairman. Between 60 and 70 were present, consisting of the male members of the staff and guests, the latter including both customers and competitors. There were the usual toasts, and altogether a very successful and enjoyable evening was spent. The toast of the "Army and Navy" was responded to by an ex-member of the staff, Corporal T. Taylor (home on leave), who joined up at the beginning of the war, and saw service in Gallipoli, Mesopotamia, and afterwards in France, where he gained the Military Medal.

The clerical staff of the St. Helens Cable and Rubber Co., Warrington, held a whist drive and social last week. Miss L. Evans, welfare superintendent at the works, distributed the prizes.

Trade Announcements.—Mr. T. W. F. Day, electrician, of 10, Union Street, Dewsbury, is resuming business on his discharge from the R.E.

Mr. E. W. Clarke, electrician, having been released from the Forces, has resumed business at 33, Shakespeare Street, Stratford-on-Avon.

Messrs. A. H. Turner & Co., electrical engineers and contractors, have commenced business at 29, Mackenzie Street, Slough.

Non-Ferrous Metal Industry Act.—The issue of the *London Gazette* for January 24th contains further additions to the list of licences under the Act.

Definition of the "End of the War."—A White Paper, issued on Saturday, contains the first and second reports of the Select Committee appointed to consider the report of Mr. Justice Atkin's Committee with regard to the provision to be made by Parliament for defining the meaning of the phrase, "End of the War," and other similar phrases used in the war emergency statutes, and for extending or shortening the period of operation of the several emergency statutes and regulations.

With regard to the first part of the terms of reference, the Committee recommend that legislation should be introduced to declare that the date of the ratification of the Peace Treaty should be the date referred to in those phrases.

On the question of extending or shortening the period of operation of the many emergency statutes, the Committee think that a new Select Committee should be set up immediately to continue the inquiry, which it has been impossible to complete.—*The Times.*

A Banker on Industrial and Trade Questions.—Speaking at the annual meeting of Barclay's Bank, Mr. F. C. Goodenough, the chairman, said that they had ample funds to meet the requirements of manufacturers and traders as soon as they could get to work and produce the goods for which the world was waiting, and so by the profits of industry make good the wastage of the war. Prompt return to peace production, with a far greater output, and an extension of foreign trade were the vital necessities of the moment. For this they must create conditions favourable to an increased output coincident with a reduced cost of production, and we must by energy and commercial insight and ability develop existing, and create new, markets.

Whatever might be the changes to be brought about by the war—and there must be many—we still must recollect that this country did not produce all that it required for the maintenance of the population, but must buy from abroad, and although through the war the component parts of the British Empire had been drawn together more closely, and there was a growing tendency to consolidation and to mutual support for purposes of exchange of raw materials and of production, as well as for the financial handling of industry and trade, still Great Britain remained the centre, and bore the greatest proportion of the burden of the debt arising out of the war. "Our export trade, both foreign and colonial, is, therefore, and will always be, a vital necessity, so that we may purchase all that we are unable to produce ourselves, and especially raw materials. We must also have such profits from our industry and trade so that, besides buying what we require, we may have a margin for ourselves, and profits will provide, through taxation, the interest and Sinking Fund on our National Debt. It is in order to organise the resources of the country for cheap production and facilities for trade so as to reduce costs without reduction of real wages or of profits that the combinations in industrial and financial institutions are now taking place. Apart from the profits of the soil, the profits which more than any other benefit the community as a whole are derived from foreign trade. Although we may individually grow richer or poorer through our internal or domestic transactions, or by shifting the burden of debt from one to another according to his or her ability to pay, the balance of the external indebtedness of the community as a whole can only be reduced by profitable sales in foreign markets."

Mr. Goodenough continued: "It is also essential that conditions both as regards cost of production and labour should be such as to enable profit to be made, because if wages reach the point where they eat up all profits the funds available for direct taxation on its present basis will disappear, and with it the trade on which the profits are earned, and, in consequence, the livelihood of the people employed in that trade. In other words, production will be prejudiced, and it cannot be too strongly emphasised that the greater the volume of production, the larger will be the proportion of actual commodities which will fall to each individual. On the other hand, any reduction in production, whether caused by inability to sell profitably or by the wilful limitation of output, affects alike the poor and the rich, the employer and the employé. The problem is, therefore, one which the wage-earner should study and understand. He should endeavour to realise the fundamental fact that as a nation we can only consume to the value of what we produce, and if production falls away then there will be less to go round, with the consequence that each individual will not only live on a lower scale, but he will have to pay more for the things that he does obtain. Profits are, therefore, essential, for, apart from the important considerations mentioned, they afford the basis of direct taxation, and it is only by maintaining profits at a reasonable level that the wage-earner can be largely exempt. In the matter of production the banks can help, without necessarily following the German plan, of which we have heard a great deal—that is to say, of investing the money lodged with them in the capital undertakings of industry, so that the whole of that country's resources were locked up. Both Germany and Austria were overtrading, and neither therefore had reserves to enable them to tide over bad times, or to give them staying power. But, with ever-increasing expenses and higher cost of living and taxation, their insatiable greed and unbridled ambition induced them continually to expand their industry, and ultimately to attempt further expansion by force."

To Restrict Imports.—A deputation consisting of Mr. G. Terrell, M.P., president of the National Union of Manufacturers, Mr. Bremner, of the British Engineers' Association, and others, waited upon Sir Albert Stanley, the President of the Board of Trade, recently to urge that the restrictions on the importation of goods of foreign manufacture should be immediately re-imposed and strictly enforced. Press reports state that Sir Albert pledged himself that the restrictions which had been lifted for three months should be re-imposed at the expiration of that period, and that the manufacturers of the country should be consulted before further removals of restrictions were ordered.

Strike.—According to the *Manchester Daily Dispatch*, a strike recently arose at the Prescot works of the British Insulated and Helsby Cables, Ltd., the point of difference being whether the night-shift men should be paid at time-and-a-quarter, as demanded, or time-and-a-fifth, as the employers had conceded. About 2,500 men were affected.

An Exhibition at Glasgow.—It is proposed to hold an Exhibition in Glasgow, under the auspices of the Corporation, for engineering, including electrical and shipbuilding. A Committee has been appointed.

New Swedish Company.—Among the new companie recently formed to establish electric lighting and power installations in Sweden are the Yttersbafors Elektriska Aktiebolag, formed at Stannur, with a maximum capital of £25,000, and the Hedesunde Elektriska Aktiebolag, Hedesunde, maximum capital, £8,500.

Book Notices.—"B.E.A.M.A. *Journal*." Vol. V. No. 1. January, 1919. London: Oakley House, Bloomsbury Street, W.C. Price 1s. net.

"The Central," the journal of the old students of the City and Guilds (Engineering) College. Vol. XV. No. 44. December, 1918. London: The College. Price 2s. 6d.

"Annales des Postes, Télégraphes, et Téléphones." December, 1918. Paris: A. Dumas. Price 14 fr.

American Foreign Trade Plans.—According to a U.S. wireless dispatch from New York, published in the *Evening News*, Secretary of Labour William B. Wilson says that the U.S. Government has already made provision for the country's foreign trade through the establishment of commercial attachés abroad and of branches of the Federal reserve bank for foreign countries, and the starting of a shipping programme of sufficient magnitude to take care of the foreign trade.

Catalogues and Lists.—THE BRITISH EVER-READY CO., LTD., Hercules Place, Holloway, London, N. 7.—1919 catalogue (24 pages), containing full particulars, with illustrations and prices, of a great variety of their electrical specialities—battery pocket lamps, scout and inspection lamps, torches, signalling and hand lamps, bicycle lamps, electric lanterns, electric gas lighters, motor-car accessories, and so forth.

MR. F. J. HASTINGS, 59, Islington Row, Birmingham.—Priced leaflet showing the "Oxford" scissors arc lamp.

Fire.—With reference to the note in our last issue respecting the fire at the works of the Siluminite Insulator Co., Ltd., it should be stated that this was due to a cause outside the building. Though the flames reached to a great height, the employés behaved most gallantly, and prevented disastrous consequences. The whole of the stock of Siluminite, which was right in contact with the fire, was saved.

LIGHTING AND POWER NOTES.

Aberdeen.—EXTENSIONS AND NATIONAL SUPPLY.—The Electricity Committee has recommended the T.C. to consult Mr. J. H. Rider as to whether the extensions in progress and contemplated in connection with the electricity undertaking are upon the best lines, in view of the local conditions and the proposed centralisation of electricity supply.

PROPOSED LOAN.—The Electricity Committee has recommended the T.C. to apply to the Secretary for Scotland for consent to a loan of £100,000, for extensions in connection with the electricity undertaking.

Battle.—PROPOSED E.L.—The Council has decided to consider an E.L. scheme for the town, which has been proposed by Mr. J. A. Tasker, of Park Gate, Battle.

Beccles.—PROPOSED E.L.—The T.C. has appointed a Committee to consider an E.L. scheme for the town.

Belfast.—STRIKE.—The members of the Shipbuilding and Engineering Federation in Belfast struck work on Sunday last, and as the employés of the municipal electricity, gas and tramway departments are members of the Federation, the whole of the lighting and tramway services came to an end. The Federation had been agitating for a shorter working week, and the employers offered a 47-hour week. This was not acceptable to the men, who demanded a 44-hour week within 10 days, and as this demand had not been granted when this period expired last Sunday, the men struck work at noon. At the meeting of the Strike Committee, letters from the employers asking for further time to consider the matter was read and passed over without discussion. Besides causing great inconvenience owing to the lack of any lighting, the absence of gas and electricity for power purposes in the mills and factories resulted in thousands of workers in other trades becoming idle. The strikers agreed to a supply of electricity being given to local hospitals, but this ceased at 9 a.m. on Monday. In the afternoon a joint meeting of the Electricity, Gas and Tramways Committees received a deputation of the strikers, and it was arranged for the supply to hospitals to be resumed that night, on condition that no public or private consumers were supplied, in which event the men threatened to cut the mains. Owing to the fact that most of the bakeries use gas or electric power, something like a bread famine was experienced.

On Tuesday the Lord Mayor issued a statement to the effect that there were no differences whatever between the Corporation and

its employés, who struck purely in sympathy with other industries in order to force the hands of the employers. The Municipal Employés' Association instructed its members to return to work, and the Lord Mayor assured them of adequate protection if they did so.

Bexhill.—PRICE INCREASE.—The T.C. has increased the price of electricity to a flat rate of 6d. per unit, plus 25 per cent.

Bury.—PROPOSED EXTENSIONS.—The Electricity Committee has under consideration the question of extensions at Chamber Hall power station, and has applied to the L.G.B. for the necessary borrowing powers.

Canada.—NIAGARA POWER MERGER.—The Niagara Falls Power Co., the Cliff Distributing Co., and the Hydraulic Power Co. of Niagara Falls, have been consolidated into a new corporation under the name of the Niagara Falls Power Co., thus creating the largest electric power company in the world in the point of output. Including its subsidiary, the Canadian Niagara Power Co., the company has an installed capacity of about 370,000 H.P., and is installing an additional 100,000 H.P., to be ready for operation during 1919. It is proposed to replace one of its present 100,000-H.P. plant with a new 200,000-H.P. plant.—*Electrical News.*

Continental.—GERMANY.—The *Handelsblad* states that matters have now reached such a pitch at Berlin, owing to the coal strikes and the attempts to Socialise the mines, that householders may henceforth use no gas between 8.30 p.m. and 11 a.m., and between 2 and 5.30 p.m. Street lighting must be reduced to 20 per cent., while restaurants, theatres, &c., may only use 50 per cent. of the electricity required in December, 1918. *Vorwärts* learns from official quarters that the coal scarcity is so acute that, within a few days, not only will the main electric generating stations have to close down, but also all other trades requiring coal.

STRIKE.—The electrical workers at Berlin, who struck on Tuesday last week, resumed work on Wednesday. For one day the whole of the electricity supply of the city was suspended. Factories ceased work, and tramcars were stranded in the streets.

Owing to the strikes in Upper Silesia, Leipzig is without electricity or gas.

ITALY.—Concessions have been granted for the construction of two artificial lakes in the Valley of Vogna and one in the Valley of Sesia, and their utilisation in connection with three waterfalls, so that the total plant will furnish 35,000 H.P. at Vogna, Riva Valdobbia, and Bulmuccia.

NORWAY.—WATER POWER.—From reports which have recently appeared in Stockholm, it appears that during late years the demand for electric power in Norway has increased so enormously, not only in the cities, but also in the country districts, that the water power now developed is not nearly sufficient. The shortage has been felt especially in the eastern and southern part of the country, and in the smaller counties. The delivery of 150,000 H.P. to the eastern part from the Tysso Falls, in the Hardanger district, will, however, ease the situation in this district. There seems to be good prospects of finishing the trunk line, *viâ* Seljestad and Kongsberg, to Christiania and other districts this year, commencing with 30,000 H.P. and increasing to 150,000 H.P. The promise of high Government officials has been obtained to supply a quantity of cable, of which there is a great shortage in Norway. When all the works at Tysso Falls are ready, say in three or four years, it will be possible to supply the trunk line with 275,000 H.P. When all working expenses, interest, amortisation, and taxes have been paid, the cost of production will be about 1 cent. per unit, delivered at Christiania. It is expected that the trunk line can be supplied with 4,000,000 to 5,000,000 H.P. in the near future. In the inner Hardanger and Telemarken districts alone 1,500,000 H.P. are available near the trunk line, which may be directed toward the east and south.

The manager of the Christiania Electrical Works has been working on a plan with regard to power lines for the city. The first step was taken in January, 1916, when the municipality bought Holsvarsvattnet, estimated to deliver 100,000 H.P. The next step was the purchase, in December, 1917, of a series of waterfalls in the Hallingsdals River, giving 40,000 H.P. The purchase of Aurland Falls, in the western country, for $1,340,000, some months ago, was the last step in this plan. These falls are estimated to supply 300,000 to 400,000 H.P. The trunk line from the Aurland Falls to Christiania will be about 180 miles long.

Akershus County Council, last year, decided to exploit the Raanaas Falls, in the Glommen district, and the work is progressing. The falls will produce about 64,000 H.P. The expenses are estimated at $5,000,000. The work is expected to be finished in about four years, and only Norwegian labour is to be employed.

Canada has already been keenly investigating the Norwegian market for machinery supplies. It is obvious that there will be a big demand for cable, too. It was only in May, last year, that the first Norwegian cable factory was completed, near Christiania. All kinds of wire and cable, as well as transformers, are to be made.

Eccles.—INQUIRY.—We regret that the note which appeared under this heading in our last issue was based upon incorrect information. No inquiry with regard to the electricity works is contemplated.

Edinburgh.—STRIKE.—Men in the electrical engineering trade went on strike on Monday, in defiance, it is stated on behalf of the employers, of an agreement arrived at last week, when it was agreed to introduce a 47-hour week. After Monday the men are understood to be striking for a 40-hour week.

Ennis (Co. Clare).—PROPOSED E.L.—Next month the U.D.C. is to consider an E.L. scheme for the town.

Lancashire and Cheshire.—LINKING-UP.—Mr. J. A. Robertson, electrical engineer to the Salford Corporation, who acted as hon. secretary to the Committee appointed to draw up a scheme for the inter-connection of the Lancashire and Cheshire electricity supply systems, states that the opposition of certain of the smaller municipal undertakings prevented the adoption of the scheme, which would have brought about a centralised system, and, besides saving an immense sum per annum in coal and labour, would have enabled the municipal authorities to meet the growing demand for power for industrial works. Had the scheme been adopted, it would have obviated the necessity for Government action so far as Lancashire and Cheshire are concerned.

London.—STRIKE.—Electricians and other tradesmen downed tools on Monday at Poplar and Millwall, in sympathy with the Port of London ship repairers who are on strike.

New Zealand.—WATER POWER.—A movement, supported by practically the whole of the governing bodies of Otago, is being organised to urge upon the Government the necessity for deciding upon a hydro-electric power scheme for the industrial and agricultural advancement of Otago.—*B. of T. Journal.*

Oldham.—FUEL ECONOMY.—The B. of T. (Coal Mines Department) has congratulated the Corporation upon the fact that during the six months ended September 30th last the coal consumption per unit at the Greenhill generating station was 2·66 lb., compared with 2·71 lb. for the previous year, and about 6 lb. five years ago.

Portsmouth.—THREATENED STRIKE.—Since August last the employés at the Corporation electricity department have been asking for a war bonus (28s. 6d. per week), but without success. On Friday, last week, they threatened that if their demand was not granted they would cease work that day. On receipt of this ultimatum the Mayor had a consultation with the chairman of the E.L. Committee, as a result of which the men were informed that their demands would be complied with.

Rotherham.—YEAR'S WORKING.—The total revenue of the Corporation Electricity Department for the year ended March 31st, 1918, was £78,013, compared with £49,069 in the preceding year, while the working and management expenses amounted to £58,311, against £33,198. The average price received per unit sold was ·863d., against ·901d.; the total cost per unit was ·651d., against ·615d., and included generation costs, ·528d., against ·452d.; distribution, ·042d., against ·038d.; rents, &c., ·025d., against ·074d.; management expenses, ·044d., against ·045d.; and special charges, ·012d., against ·006d.; 25,457,619 units were generated during the year, against 15,612,275, and 21,490,165 were sold, against 12,949,211, including 477,561, against 482,987, for lighting, 18,575,854, against 10,176,124, for power, and 2,436,750, against 2,290,100, for traction; 2,739,096, against 1,036,444, were used on the works, and 1,228,358, against 1,626,620, were unaccounted for. The number of consumers increased from 900 to 949, and the maximum demand from 6,000 KW. to 7,000. Of the gross profit of £19,702, debt redemption absorbed £6,426, and interest £7,714, leaving a net balance of £5,562, against £5,324 in the previous year. The renewals fund now amounts to £8,455. The total capital expenditure was £388,511.

Stirling.—PROPOSED BULK SUPPLY.—With reference to the application of the T.C. to the Scottish Central E.P. Co. for terms for a bulk supply of electricity, the company has offered to supply and install in the Council's existing power station the transformers and switchgear necessary for the conversion of the supply, in exchange for the boilers, generators, and other plant at present in the station, with the exception of the main switchboard. The charge for energy would be £4 per KW. per annum, plus 6d. per unit consumed, plus ·015d. per unit for every 6d. increase in the price of coal over 10s. per ton. The proposal was remitted to the Council's consulting engineer (Mr. J. A. Robertson, of Salford), who reported that he did not think the Council should entertain the offer, as the rates proposed were 14 per cent. higher than the cost of generating at the Council's own works, and there was also the possibility of a central authority being established at an early date to operate all the generating stations in the district. The Council refused the offer, and the Lighting Committee is to consider the installation of condensing plant and the reduction of the costs in connection with the undertaking.

Taunton.—PROPOSED PRICE INCREASE.—As it is estimated that there will be a deficiency of about £2,000 on the present year's working of the electricity department, the E.L. Committee recommends that the price of energy be increased before March 31st next.

Truro.—PROPOSED E.L.—The T.C. is considering the question of applying for an E.L. prov. order, and has been recommended to purchase electricity in bulk from the Cornwall E.P. Co.

Uruguay.—STATE ELECTRIC ENTERPRISES.—The Government is extending its functions as owner and manager of electric plant for traction, power, and lighting purposes. For some time the State Electric Power Administration has controlled and operated the electric plant at Monte Video, Colonia, Canelones, Maldonado and Pando; and the plant at Mercedes (valued at £20,000) is amongst the Government's latest acquisitions.

Wexford.—PROPOSED E.L.—The Corporation has decided to engage an expert to advise it in connection with an E.L. scheme.

TRAMWAY AND RAILWAY NOTES.

Australia.—Strikers Fined.—For participation in the recent strike, the Perth Tramway Union has been fined £25, and several tramway Unionists £5 each.—*The Times.*

Belfast.—The Corporation tramway men, who have been forced to cease work, owing to the failure of the electricity supply, due to the general strike, and who claimed their wages on the grounds that they were not on strike, but locked out, have been given a week's notice to end their services.

Continental.—France.—Owing to the refusal of their demands for better conditions and increased pay, the employés of the Nord-Sud and Metropolitan Railways, and the tramway and omnibus services in Paris, struck work on January 24th. The demands comprised a guarantee of regular employment, an eight-hour day, increased wages of 1s. 8d. per day from January 1st, the restoration of the bonus of 2s. 6d. per day withdrawn in July last, a minimum pension of £80 per annum after 20 years' service, and an annual holiday of three weeks. The control of the profits of the undertakings, and the adoption by the Senate of the Pension Bill for light railway workers, were also demanded. On Saturday, in order to maintain the transport services, the Government decided to take over the lines affected, and urged the employers and strikers to enter into negotiations for a prompt settlement. The men were also informed that all provisionally demobilised men who did not resume work would be recalled forthwith. On the understanding that negotiations would be entered into with regard to their grievances, the men decided to resume work, and normal services were running on Sunday morning.

The arrest of the secretary of the men's Trade Union has called forth protests among the militants. The *Matin* says that other arrests are imminent.

Spain.—Proposed Electric Railway.—The Minister of Public Works is introducing in the Senate a Bill for the construction by the State of a direct electric railway from the French frontier to Algeciras.—*Financial Times.*

Application has been made by Messrs. Luis Rodriquez & J. Cassi for a concession for an electric tramway from Oviedo to Pasada de Llanera.

Plans have been prepared for an electric tramway, 9,830 metres in length, from the Puerta del Duque, Saragossa, to the canal at Casablanca. Three 20-H.P. cars will be used, and the carriage of goods is an important element of the undertaking.

The International Commission for the building of the Trans-Pyrennean Railway, composed of French and Spanish delegates, has decided that the portion of the line through the Somport Tunnel, about seven kilometres in length, shall be electrically equipped. Energy will be supplied by the Compagnie du Midi.

Italy.—The Società delle Ferrovie Nord-Milano has decided to electrify the whole of its network. Government sanction has already been obtained for the conversion of the Milan circular railway, but the work on the Milano-Varese-Como and the Saveso-St. Pietro-Camnago lines is dependent on negotiations with the Government anent the modifications of the terms of the concession as to the date of redemption.

Coventry.—Tramway Renewals.—The city tramways are to be reconstructed, at an estimated cost of £333,616.

Dewsbury.—Extensions.—Proposals which received the L.G.B. sanction before the war for the extension of the tramway system to the Dewsbury boundary at Shaw Cross, and for lines through the Market Place, are shortly to be put into execution.

Egypt.—Owing to continuous rains, Cairo and the surrounding districts have been flooded. Tramway and other traffic was interrupted for some time, and electric light and telephones have also been interfered with.—*The Times.*

Haslingden.—Electric Vehicles.—The T.C. has appointed a Sub-Committee to inquire regarding petrol and electric vehicles, for a proposed service from Helmshore to Haslingden.

Huddersfield.—Extensions.—The Corporation has assured the Brighouse Corporation that at the earliest opportunity the projected extension of through tramways to Brighouse, *viâ* Rastrick, will be put in hand, steps having already been taken to further this object.

Lancashire.—Proposed Light Railways.—The Light Railway Commissioners have authorised the construction of light railways in Little Crosby, Ince Blundell, Altcar, and Formby.

London.—Traffic Congestion.—At the L.C.C. meeting, last week, the chairman of the Highways Committee said that the Committee recognised that the present tramway services were insufficient, but, owing to the increase of traffic, the absence of a large proportion of the staff on national service, and the depreciation of material, it was impossible to maintain adequate services. The employés were now being demobilised, and materials were being pressed for. The Committee was willing to spend any amount of money to restore the pre-war efficiency, and was framing estimates for a tremendous work of renewal.

The traffic superintendent of the District Railway informed a Press representative that the queue system instituted on some platforms had proved a great success, and was to be extended. The escalators were also very successful, and at some stations were used by as many as 1,500 persons per hour. A new signalling system is now being installed, which will facilitate the running of the trains.

Delays on the District Railway, early on Monday morning, were caused by a film of ice on the conductor rails in the exposed parts of the system.

Failure of Signals.—Owing to the failure of the signals between Lambeth North and the Elephant and Castle Stations, the south-bound trains on the Bakerloo Railway were held up for half an hour on Saturday.

Morecambe.—New Cars.—The T.C. has decided to purchase two "toast-rack" tramcars and two mechanically-driven 'buses.

Railway Men's Working Hours.—A conference of the N.U.R., held in London on Saturday last, issued a statement to the effect that a serious view was taken of the apathy of the Prime Minister to the national programme submitted by the Union, and if a strike on the whole of the railways on February 9th was to be avoided a Committee should be appointed immediately to negotiate with the men's Committee.

Stalybridge.—Year's Working.—The estimated loss on the tramway section of the Stalybridge, Hyde, Mossley, and Dukinfield Joint Tramways and Electricity Board last year was £4,000, and it has been decided to issue a precept for £1,000 upon each of the four constituent Corporations.

Stirling.—The T.C. has decided to obtain expert advice on the position of the tramway undertaking.

TELEGRAPH AND TELEPHONE NOTES.

Automatic Exchanges.—The telephone service again came up for discussion at the Leeds Chamber of Commerce meeting last week, and it was resolved to advocate the installation of the automatic system throughout the whole of the Leeds area.

Cable Delays.—With regard to the prolonged telegraphic delay with England, the *Handelsblad* learns that five of the twelve cable wires are defective. In order to reduce delays, telegrams are sent to England by every mail boat. Belgian telegrams for England are sent *via* Holland owing to the defective condition of the cable between Ostend and England.—*The Times.*

France.—In order to relieve the pressure on the ordinary telegraph system between Paris and Brussels, the French Ministry of Posts and Telegraphs has inaugurated a wireless system between the two cities.

Future of War 'Phones.—Thousands of miles of telephone wires were taken across country during the war for the purpose of connecting with existing stations all the new camps, aerodromes, training schools, and factories. For the defence of London and other centres, farms and positions of strategical value were linked up in the same manner. The future of these telephone lines has not yet been finally determined, but it is highly probable, the *Daily News* is informed, that those that are not wanted for Army purposes and are considered useful by the Post Office will be retained for public use.

Mexico.—A new wireless station has been erected at Lobos Island, near Tampico, to enable the petroleum companies to correspond with ships at great distances.

Morocco.—Tenders were called for in November last for the construction of a telephone network in Spanish Morocco, the plans contemplating the service of 100 subscribers, 600 lines, and a total outlay of 39,354 pesetas. The result of the competition has not yet transpired.

Multiplex Telephony.—The new multiplex system makes use of alternating currents whose frequencies occupy a range between the frequencies of the ordinary telephone currents, which are those of the human voice, and the lowest frequencies which are used in wireless communication. This frequency range has not heretofore been commercially used. Each additional circuit in the new system makes use of some frequency within this range. At the sending end of each circuit the ordinary telephone currents are made to modulate this "carrier" frequency, so that the current sent out on the line varies with the amplitude of the ordinary telephone currents. At the receiving end the carrier current is put into a demodulating circuit, which then gives out the original telephone current. The different circuits are kept separate at each end by inserting in each circuit a combination of impedances which make up an electrical "filter." This transmits only the range of frequencies peculiar to that circuit. In wireless working it is sufficient to send and receive in "tuned" circuits. In the multiplex system, however, tuned circuits would not be sufficient, since each telephone channel occupies a range of frequencies of about 2,500 cycles, and any circuit tuned to these comparatively low frequencies would be too selective to receive such a range in the proper manner. Vacuum tubes are used in the modulating and demodulating circuits, and are also used as amplifiers in the transmitting and receiving branches, and at intermediate points along the line where necessary, to prevent the currents from becoming too highly attenuated.—*Electrical World.*

Snowstorm.—The snowfall on Monday last brought down the telephone and telegraph wires at Hitchin, Woking, Manchester, and in Northamptonshire.

Uruguay.—A new underground telephone system is planned for Monte Video, and an invitation has been issued to any firms desirous of studying a suitable system.

Wireless Board.—In the January Navy List are given details of the membership of the new Wireless Telegraph Board under Capt. J. A. Slee, R.N. The Board consists of three naval members, two military members, and two Air Force members.

Wireless Telephony.—The *Daily Mail* states that aeroplanes now carrying Peace-Conference delegates and documents between London and Paris are to be fitted with wireless telephone apparatus. An American engineer from the Western Electric Co. recently visited England to investigate the wireless telephones of the Royal Air Force, and to make comparative tests with American instruments. He declared that the British wireless telephones are far in advance of those in use in the American Air Force. Pilots can speak to their ground commanders and to one another at a distance of 15 miles, and the only difficulty in communicating between machines or with the ground at greater distances is the consideration of the weight of larger instruments. Between airships, for instance, it is possible to carry on conversation at a distance of 50 miles.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—SYDNEY.—April 28th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney. A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

May 19th. Municipal Council. Boiler-house equipment. Specifications on February 17th, from Messrs. Preece, Cardew, Snell and Rider, 8, Queen's Gate, S.W. See "Official Notices" to-day.

MELBOURNE.—March 4th. Deputy Postmaster-General. Cables (schedule No. 1,504). A copy of the specification may be seen at the Inquiry Office, Department of Overseas Trade (Development and Intelligence).

March 10th. City Council. One 5,000-kw. frequency changer, high-tension switchgear. Specification (£1 1s.) from City Electrical Engineer.

Belfast.—February 6th. Midland Railway Co. (Ireland). Northern Counties Committee. Electric lamps, carbons, batteries, telegraph wire, &c., for 6 or 12 months. Mr. Ellis, Stores Superintendent, York Road Station, Belfast (Form 27, price 6d.).

February 15th. Tramways Committee. Tramway stores (including several electrical items). See "Official Notices" to-day.

February 24th. Electricity Department. Electric and hand cranes, pumps and tanks. See "Official Notices" January 17th.

Belgium.—February 14th. The municipal authorities of Herstal, near Liege, are inviting projects until February 14th, for a system of electricity distribution in the town.

Glasgow.—A.C., 1,500-KW., 50 periods, three-phase, 3,000-volt generating plant, boilers, engines, switchgear, &c. Specifications from Mr. W. D. Robertson, M.I.M.E., Glasgow. For further particulars see "Official Notices" January 24th.

Liverpool.—February 3rd. Tramways Committee. 50 electric tramcars. Mr. C. W. Mallins, General Manager, 24, Hatton Garden, Liverpool.

London.—ST. PANCRAS.—February 12th. B.C. Two steel-cased water-tube boilers, superheaters, economisers, stokers, fans, &c. See "Official Notices" to-day.

Manchester.—February 11th. Tramways Committee. (*a*) Tramcar motors. (*b*) Tramcar trucks. J. M. M'Elroy, General Manager, 55, Piccadilly, Manchester.

New Ross (Co. Wexford).—February 20th. Gas and Electricity Supply Co., Ltd. Suction gas plant and dynamos, storage battery, main switchboard, overhead lines and street lamps. See "Official Notices" January 24th.

Stretford.—February 8th. Electricity and Tramways Committee. Electricity converter station at Old Trafford. Specification, &c., from Mr. E. Worrall, Surveyor, Council Offices, Old Trafford.

Tuamgraney, Scariff (Co. Clare).—February 15th. Messrs. Lysaghts. One hydraulic turbine, dynamo, and pipe line, electric motors and wiring. Specifications from Mr. L. J. Lawless, Rathmines, Dublin. See "Official Notices" to-day.

CLOSED.

Willesden.—U.D.C. Charging plant and equipment, £654. General Electric Co., Ltd.

FORTHCOMING EVENTS.

London Association of Foremen Engineers.—Saturday, February 1st. At 7 p.m. At Cannon Street Hotel. Paper on "Employers and Employed," by Mr. H. B. Graham.

Society of Engineers.—Monday, February 3rd. At 5.30 p.m. At Burlington House, Piccadilly, W. Presentation of premiums by Mr. W. B. Esson, and Presidential address by Mr. W. Noble Twelvetrees.

Junior Institution of Engineers (N.E. Section).—Tuesday, February 4th. At 7.15 p.m. At the Mining Institute, Newcastle. Paper on "The Construction of Large Transformers."

Roentgen Society.—Tuesday, February 4th. At 8.15 p.m. At the Royal Society of Arts, John Street, W.C. Paper on "Protection in Diagnostic Work: A Consideration of the Effects of Scattered Rays and Secondary Rays," by Mr. F. Hernaman-Johnson.

Royal Institution of Great Britain.—Tuesday, February 4th. At 3 p.m. At Albemarle Street. Lecture on "Electric Arcs and their Applications," by Prof. J. T. MacGregor-Morris.

Industrial Reconstruction Council.—Wednesday, February 5th. At 4.30 p.m. At Saddler's Hall, Cheapside, E.C. Lecture on "The Industrial Awakening," by Mr. E. J. P. Benn.

Liverpool Engineering Society.—Wednesday, February 5th. At 8 p.m. At the Royal Institution, Colquitt Street. Paper on "Electric and Oxy-Acetylene Welding and their Defects," by Mr. E. A. Atkins.

Chemical Society.—Thursday, February 6th. At 8 p.m. At Burlington House, Piccadilly, W. Ordinary meeting.

Belfast Association of Engineers.—Thursday, February 6th. At 7.45 p.m. At the Municipal Technical Institute. Paper on "Ship Riveting," by Mr. A. J. Lewis.

Greenock Association of Electrical Engineers.—Thursday, February 6th. At 92, West Stewart Street. Paper, "Some Notes on the Cabling of Public Works," by Mr. W. R. Scott.

Institution of Electrical Engineers (Students' Section).—Friday, February 7th. At the City and Guilds Technical College, Finsbury, E.C. Lecture, with experimental demonstrations, on "Oscillatory Electric Discharges"; also an Exhibition of Ancient and Modern Illuminants, by Mr. R. P. Howgrave-Graham.

Manchester Association of Engineers.—Saturday, February 8th. At 6.30 p.m. At the Grand Hotel. Paper on "Principles of Jig and Tool Design," by Mr. G. H. Hey.

Birmingham and District Electric Club.—Saturday, February 8th. At 7 p.m. At the Grand Hotel. Paper on "Signalling," by Capt. F. H. Woodrow, R.E.

OUR HALF-YEARLY INDEX.

THE Index to Vol. 83 of the ELECTRICAL REVIEW, which has now been printed, will be supplied for 3d., post free, to those who, through the post, specially apply for it. Applications should be addressed to the Publisher, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

NOTES.

National Electricity Supply.—At the quarterly meeting of the Association of Chambers of Commerce, held in London, four resolutions were on the agenda, tabled by Nottingham, Barnstaple, Walsall, and Leith, with regard to the importance of effective Parliamentary legislation to secure cheap electricity supply. The meeting considered the Leith resolution only. This stated that legislation should at the earliest moment be enacted to put into effect the recommendations of the Electric Power Supply Committee, and that, with a view to economical production and distribution, a new central authority should be appointed to regulate the generation and distribution of electricity throughout Great Britain and Ireland. Mr. Atkey, M.P. (Nottingham), said they desired to give the politicians a push; also that the best brains should draft the Bill—it should not be left to the lawyers. Mr. Russel (London) complained that the B. of T. report seemed to support nationalisation to a too great extent. Sir John Maclaren (Leeds) said the recommendations of the E.P. Committee were in the main admirable. From a technical point of view the report was excellent, but not so from a commercial point of view. It would be necessary in some way to co-ordinate the two views. In Yorkshire there were a large number of electrical undertakings which would be vitally affected, and steps should be taken to conserve the interests of local companies where the services were good. Mr. Hobson (Sheffield) said that to carry out the scheme they must have legislation far more drastic than had ever been thought of before in regard to landowners' rights to wayleaves. Mr. Shaw (Newcastle) opposed any nationalisation.

Patent Law Amendment.—We have received from the secretary of the Institution of Mechanical Engineers a copy of the Memorandum on Patent Law Amendment, based upon a report prepared by the Institution of Electrical Engineers, and adopted by the Conference of Technical Institutions on this subject. Twenty-six technical institutions and societies were represented at the Conference, which met under the chairmanship of Mr. Michael Longridge, President of the Institution of Mechanical Engineers. A Committee was formed, with Mr. M. Atkinson Adam as chairman, to formulate recommendations and to arrange for a deputation to the Board of Trade, and the Memorandum formed the basis of the remarks of the speakers when the deputation was received, on October 10th, by the Right Hon. G. J. Wardle, M.P., Parliamentary Secretary to the Board of Trade. An abstract of the Memorandum was published in our issues of November 22nd and 29th, 1918.

£60,000 for Engineering Research.—Ambrose Swasey, of Cleveland, Ohio, has just given the Engineering Foundation an additional £20,000 as an endowment for engineering research. In 1915 he gave £40,000 for the same purpose, so that his entire gifts are now £60,000. Mr. Swasey's original gift made possible the establishment of Engineering Foundation by the United Engineering Society, representing the American Society of Civil Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. Mr. Swasey's donations have been inspired by his conviction of the necessity for research in engineering sciences in connection with the war, and in keeping the United States in the forefront of the nations in industrial development in the new peace era.

The Pacific Cable.—A Treasury White Paper issued last week deals with the accounts of the Pacific Cable Board. In its financial aspect alone the report is interesting as showing the magnitude of the work of the board. The receipts for the year amounted to £411,061, this sum exceeding the expenditure by £112,068. The excess of receipts over expenditure was greater by £21,162 than that of the previous year. The net traffic receipts, £401,974, exceeded those of 1916-17 by £65,818, this being due to the larger amount of full-rate and Government traffic. The expenditure, excluding special appropriations, shows an increase of £16,125 over that of the preceding year, and £27,262 over the original estimate. This increase was due mainly to the greater cost and consumption of stores, and to heavier staff charges consequent upon the higher rate of war allowance and increased overtime charges. During the year over 7,500,000 paying words of international traffic were handled, and nearly 600,000 words of messages in relation to wounded members of the expeditionary forces were transmitted free. In addition 1,729,000 paying words were carried between Australia and New Zealand, and between Australasia and the Pacific Islands. The quantity of paying words of international traffic was less by 1,250,000 than that transmitted during the previous year (when the record total of nearly 9,000,000 words was established). This reduction was due to the enforced curtailment of cheap classes of traffic owing to connecting companies being unable to accept them. Cables continue to be heavily pressed with war traffic, and it is feared that no opportunity of reinstating the week-end and deferred Press telegrams will occur until the return to normal conditions. It is hoped, however, that the reinstatement of deferred ordinary may be possible in the near future.

During the year two interruptions occurred; the first in November, 1917, when the cable between Norfolk Island and Doubtless Bay was interrupted from the 20th to the 25th; the second was on the Suva-Norfolk Island cable, which developed a bad fault on March 18th, 1918. Total interruption did not occur until the cable ship cut in for repair on March 30th, and normal communication was restored on April 1st. Neither stoppage resulted in any appreciable loss of traffic. The injury in both cases was due to rock chafe and corrosion. Other cables worked without interruption, and continue in excellent condition. The landline across Canada from Montreal which the board leases from the C.P. Railway Co., suffered few interruptions of more than minor importance. The Melbourne-Sydney landline, which is allocated for the board's traffic, has continued satisfactorily. The new auxiliary schooner *Tangaroa* was completed and handed over by her builders at Sydney in November, 1917; she will make regular voyages between Fanning and Honolulu at bi-monthly intervals. The steamer *Iris* remains in first-class condition, and in addition to the two cable repairs referred to above, she carried out repairs in October, 1917, to the Cook Straits cables under charter to the New Zealand Posts and Telegraphs department. It is noteworthy that she completed the repair of the Norfolk Island-Auckland cable in less than 5½ days from the time of interruption. The vessel had to be put into commission and provisioned, a crew collected, and a distance covered exceeding 500 miles to the cable ground. In addition to cable operations, the *Iris* was placed in commission on two occasions, first for her cruise to Fiji and Fanning Island from July 11th to August 21st, 1917, and second in December, 1917, when she was requisitioned by the New Zealand Department of Defence to conduct a search for a party of German prisoners of war who escaped from internment at Auckland Harbour. They were recaptured at Curtis Island in the Kermadec group.

Volunteer Notes.—ROYAL ENGINEERS VOLUNTEERS, LONDON ARMY TROOPS COMPANIES.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 5, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Wednesday, February 5th.—Drill and Engineering Instruction for the whole Corps at 1830.
Friday, February 7th.—Range, 1830.

C. HIGGINS, Captain, R.E., *Adjutant.*

Electrical Engineers' War Memorial.—A Committee of the Institution of Electrical Engineers, of which Mr. C. H. Wordingham, C.B.E., is chairman, has issued a circular to the members, stating that "upwards of 130 members of the Institution of Electrical Engineers have fallen in the war, and many others are broken and disabled. While it would be impossible to add lustre to their names or adequately to express appreciation of their ungrudging service to the country and to humanity, it is fitting that means be taken to preserve the memory of those who have died, and to give such help as may be needed by those who are wounded and disabled. As an obligation, and in no sense as an act of charity, provision should be made whereby assistance can be given to the dependents of the fallen and the wounded, either by financial help or educating the children who are left."

The Electrical Engineers' War Memorial Fund has been initiated to attain these objects; it is proposed that the memorial should take the form of—

1. A permanent record in the Institution building in the form of a bronze memorial.

2. A fund for the following purposes: To assist the wounded and disabled; to provide help to the families and dependents of the killed and wounded; to provide for the education of the children of those who have been killed or permanently disabled.

The Committee formed to carry out the details of the Memorial now makes an appeal for help in placing the War Memorial on a basis which will adequately commemorate those who, in the full power of their manhood, gave freely and without question. It is the earnest wish of the Committee that the fund which is to be raised may be of a substantial character, and one worthy of the resources of the electrical industry.

Subscriptions may, if desired, be spread over a period of years. All remittances are to be made payable to the "Institution of Electrical Engineers," and to be sent to the Institution.

A Roll of Honour containing the names of members who have been reported to the Institution as having been killed in action, or having died of wounds or other causes as the result of service in H.M. Forces during the war, accompanies the circular.

Auction Sale.—The Assets Auction Co., Ltd., is selling by auction, on February 5th and 6th, at 129, Newington Causeway, S.E., a quantity of electrical machinery, ½-watt fittings, and various electrical accessories. For further particulars see our advertisement pages to-day.

Educational.—CAMBRIDGE UNIVERSITY.—The Syndicate on Engineering Studies at Cambridge University is of opinion that the professorship, rendered vacant by the death of Prof. Hopkinson, should be filled as soon as possible; the new professor should be, they urge, Professor of Engineering. His stipend should be £1,300. The existing Engineering Laboratory should be assigned to him and managed by him. The Syndicate favours a change from the system according to which the studies of the school have been under the joint control of the Special Boards for Mathematics and for Physics and Chemistry, and thinks it desirable that a separate Board of Engineering Studies should be appointed.

The *Times* says that owing to the lack of trained investigators in Canada with capacity for independent research in some department of science bearing on industrial progress, the Dominion Advisory Council has been able to award only eight Fellowships and Studentships out of the 25 for which provision is made.

British Scientific Products Exhibition.—A dinner, presided over by the Marquess of Crewe, the chairman, was given at Prince's Restaurant on January 15th, by the Committee of the British Science Guild which organised this Exhibition, to the friends and exhibitors whose financial support enabled the project to be successfully carried out. The purpose of the dinner, as stated by Lord Sydenham, President of the Guild, was to give publicity to, and invite support for, the Exhibition of British Invention and Discovery it is intended to hold during the coming summer. The aim of the 1919 Exhibition will be to act as a clearing house for new ideas, processes, and appliances which, without an opportunity of this kind, might never be afforded full opportunity for their completest utilisation in industry. The project obviously had the warm sympathy of the distinguished men of science and leaders of industry who supported the chairman, and the occasion elicited from Mr. Kellaway, M.P., Parliamentary Under-Secretary to the Ministry of Munitions, the valuable promise that the resources of the Ministry would be placed at the disposal of the Guild in making the Exhibition a success.

Incidentally, Mr. Kellaway gave some striking illustrations of the strides made by those branches of the electrical industry since 1914, which previously were at the mercy of German enterprise and intrigue. In the words of Milton, he said, we had shown ourselves to be "a nation not slow and dull . . . . but acute to invent, quick, ingenious, and searching." Further instances of this inventiveness were furnished by two of the greatest inventions brought forth by the war in the air: the one the simple and ingenious sound-ranging instrument for locating aircraft; the other, that terrific and deadly weapon of attack—he was not at liberty, as yet, to declare its nature—which had rendered our shores immune from enemy aircraft, for no airman dared to face an opponent in whose hands it had been placed.

Electrical Houses.—According to the *Daily Chronicle*, Wembley Council is considering the erection of 180 houses for workmen on novel lines. The scheme is to erect electrical houses, with a central heating station—doing away with kitchen ranges—a central wash-house, central lighting, round corners to the rooms, sliding doors, and swing windows, so that the outside of a window can be cleaned from inside.

How an American Escaped from Germany.—Lieut. E. V. M. Isaacs, U.S. Navy, escaped from a German prison camp at Karlsruhe by short-circuiting all the lighting circuits of the camp, and escaping through the barbed wire under cover of darkness.

Inquiry.—Makers of "Ferrix" transformers are asked for.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The Council has approved the formation of a Sectional Committee, one member of which will represent the Admiralty, to deal with wireless matters, which subject, the Council feels, has not been dealt with as it should have been by the Institution. It is hoped that the new Committee will rectify this shortcoming, and that it will ensure such matters being adequately discussed before the Institution in future.

The Council has also approved the formation of a Committee, to consist of seven members, and to be known as the Informal Meetings Committee, which will be in close touch with the Papers Committee, the chairman of the latter serving on the former, and their duties being similar. The new Committee will arrange meetings, and obtain papers to be read at the same, for the younger members of the Institution, which meetings are to be quite informal; smoking will be permitted, eliminating the atmosphere of restraint which must necessarily be associated with the more formal meetings of the Institution.

At the meeting of the NORTH-WESTERN CENTRE, held on Tuesday last, Prof. Miles Walker read his paper on "The Supply of Single-phase Power from Three-phase Systems," and a discussion followed.

At the meeting of the SCOTTISH CENTRE, on Jan. 14th, Mr. J. G. Neilson, the chairman, drew attention to the position of the Benevolent Fund. He pointed out that the Council was most anxious that the fund should be supported by every member of the Institution. In order that the fund should be placed on a proper footing, and local cases properly attended to, a Local Sub-Committee had been appointed for the Scottish Centre (Mr. Taylor, hon. secretary). The amount at present subscribed was very small, and he suggested an additional voluntary contribution of at least 2s. 6d. per member.

At the meeting of the WESTERN CENTRE, held at the South Wales Institute of Engineers, at Cardiff, on Monday evening last, Mr. H. I. Rogers (chairman) announced that the Committee's effort to get the area of operations extended had met with success, due in no small measure to the energies of Mr. C. T. Allan (joint hon. sec.). He mentioned that the paper which was to be read that evening had not yet been read at headquarters. Lieut.-Col. W. A. J. O'Meara, C.M.G., then read a paper on "The Functions of the Engineer; his Education and Training." The author made a strong plea for closer co-operation between the employer of labour and the technical training institutes, and pointed out the necessity for reform in engineering courses in British colleges and schools. Comparison was also made with what was being done in the United States and in Germany. The status of the engineer came within the purview of the paper, and the author advocated the establishment or constitution of a General Engineering Council, possessing statutory powers analogous to those of the General Medical Council. A lengthy discussion followed the reading of the paper.

Institution of Mechanical Engineers.—On Friday, last week, a paper on "Electric Welding," by Mr. Thomas T. Heaton, was read and partly discussed before this Institution. We hope to publish an abstract of the paper at a later date.

INDIA.—A meeting was to have been held in Calcutta, on January 3rd, under the presidency of Sir Thomas Howard, for the purpose of forming an Institute of Engineers for India.

Mr. Barker North, A.R.C.Sc. (Lond.), F.I.C., recently gave a lantern lecture on "Lightning," at the Bradford Sunday Society, in which he showed experimentally the character of the electrical discharge during a storm.

Mr. Vernon I. N. Williams, technical manager of the small tools and gauge departments of the Manchester works of Sir W. G. Armstrong, Whitworth & Co., Ltd., gave a lecture on "Fine Measurement in Engineering Workshops" before the members of the ALLEN WEST ENGINEERING SOCIETY on the 23rd inst. The attendance was over 200, and, by the courtesy of Dr. Burnie, of the Technical School, Brighton, the Lecture Theatre at the school was made available for the Society.

NATIONAL ELECTRICITY SUPPLY.—Speaking at a meeting of the JUNIOR INSTITUTION OF ENGINEERS, on Monday, Mr. W. J. Tennant referred to the Government Report on Electricity Supply Stations as having rather raised discussion than settled this question, so important both to manufacturers and to private citizens. Mr. W. H. Patchell gave a summary of the Board of Trade recommendations. The cost of driving factories bore, he said, in nearly all cases a small proportion of the manufacturing costs, and any possible saving on the cost of electrical driving paled before the possible saving in the cost of labour, especially in view of the demand of labour for shorter hours and increased wages. In the Government scheme the interconnection of the stations would increase their capacity and help to distribute their energy in industrial districts. Existing private plant would not be interfered with, but new private plant would be standardised with the general system. Subsequent speakers expressed doubt as to the possibility of supplying power over great distances more cheaply than by the present system.

FUEL ECONOMY AND HEALTH.—In the concluding lecture at the Royal Society of Arts, under the auspices of the Chadwick Trust, Mr. A. H. Barker confined his attention to fuel economies and economics. He stated that the present total consumption of the country for domestic purposes was about 30 million tons per annum. This quantity could be reduced to six million tons per annum by the application of the best-known appliances in place of the existing ones. The necessary capital outlay on plant to secure this result would probably be from 30 to 50 million pounds. He believed that stringent Government regulations as to the means of using fuel would be quite practicable; means of using fuel which were notoriously extravagant without any compensating advantages should be strictly prohibited.

Analysing the advantages and disadvantages of a supply of heat, hot water, and heating power from a central station, he concluded that, in general, the proposal was not economically sound. It had been suggested that electrical power might be supplied in the future at one farthing per unit. If this great ideal could be realised, he believed that electricity would be sufficiently economical to make it well worth general adoption for cooking, to a certain extent for heating, and to a much smaller extent for hot-water supply, not on account of its financial economy, but on account of the extreme convenience with which it could be manipulated. Electricity at one farthing per unit was, in fact, the solution of an enormous series of problems.

At a meeting of the MANCHESTER ASSOCIATION OF ENGINEERS on Saturday last, a discussion took place on "The Past, Present and Future of Electricity Supply." Mr. S. L. Pearce opened the discussion with a review of the subject, and many other speakers took part in it. Our report of the proceedings will appear in our next issue.

The Training of Able-bodied Sailors and Soldiers.—The fact that, as a result of the conditions brought about by the war, the majority of able-bodied men born between the years 1896 and 1901 are without vocational training for industrial or commercial life, while the weak and sickly who were unfit for active service have in many cases received valuable intensive training, possesses grave potentialities which call for prompt and energetic measures, lest the skilled trades get into the hands of the physically unfit, and the able-bodied men, who have already sacrificed so much for their country, be faced with the alternatives of emigration or descent to the ranks of unskilled labour. This is the subject dealt with by Mr. Douglas Cockerell in a pamphlet recently issued by the Arts and Crafts Society, entitled "A National Scheme for Vocational Training for Able-bodied Sailors and Soldiers" (London: John Hogg, price 6d. net). The author premises that experience in the production of munitions has shown that it is possible by short periods of intensive training to convert unskilled workers into useful producers within narrow limits; men 23 to 25 years old cannot be subjected to long periods of apprenticeship or college training; and that the interval which must elapse before such men can safely be demobilised can be utilised for vocational training. He then outlines a scheme of training adapted to the needs of the building trades, and urges that similar schemes should be got out for other industries, and put in force as soon as possible; as he says, "it is clearly the country's duty to return men to civil life in a state to earn their living," and his scheme would not only provide for this, but would also be productive. The idea certainly appears to be an admirable one.

Fatalities.—A young man named Hutchinson (20) was killed whilst employed on an electric coal-cutter at Cossall Colliery, Ilkeston Junction. He had been discharged from the Army a fortnight. The Coroner said there was no evidence to show how the machine became "alive." He hoped the matter would not rest there, but that the company would try to find out the cause. Reports in the local Press do not say whether the case was watched by the Electrical Inspector of Mines.

A sequel to a fatal accident at Messrs. Osborne, Graham & Co.'s shipyard, Hylton, Sunderland, on December 14th, when J. E. Berry (17) was killed, was the prosecution of the firm at Sunderland for three offences under the Factory and Workshops Act, for which they were fined £50 in the first case and £5 and 40s. costs in each of the other two cases. According to the report in the *Leeds Mercury*, Berry received a shock at 250 volts in lifting an electric radiator, the metal work of which had not been earthed as demanded by the Regulations. Had it been earthed the accident would not have happened. On behalf of the firm, it was stated that it was the first accident through electricity that had occurred in the yard during the past ten years. Owing to shortage of labour the electrician had been overworked, and it was probably due to this strain that the slip had been made. The Bench expressed the opinion that there had been great carelessness.

Appointments Vacant.—Assistant telegraph engineers (£350 + £100) for the Government of the Gold Coast; mains assistant for the Kettering U.D.C. Electricity Works; power station engineer ($450 per month, Straits dollar is fixed at 2s. 4d.) for the Singapore Electric Tramways, Ltd.; power station staffs for the Northern Command; shift engineers (60s. + 12½ per cent.), fitter driver (55s. + 12½ per cent.), engine driver (45s. + 12½ per cent.), stokers (45s. + 12½ per cent.), foreman wireman, wireman, wireman's mate (Trade Union rate plus 12½ per cent.); chief lecturer in Electrical Engineering (£300) for the Rutherford Technical College, Newcastle-on-Tyne; two junior outside distributing engineers for the Hackney B.C. Electricity Works; depôt superintendent (£250) for the Southport Corporation Tramways Department; charge engineer (£216) for the City of Norwich Corporation Electricity Works; shift engineer (£4) for the Greenock Corporation Electricity Department. See our advertisement pages to-day.

Berlin Tramways Technical Staff.—The *Times* states that exorbitant wages are being demanded by the technical staff of the Berlin Tramway service, who are threatening to strike if they are not granted

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Mr. H. C. LAMB, resident engineer at the Manchester (Stuart Street) Corporation electricity generating station, has been appointed deputy chief engineer, in succession to Mr. A. E. Mackenzie.

Mr. E. W. SLEIGHT, who lost a leg through wounds received in action, is to resume duty as manager of the City of Carlisle electric tramways next month. Mr. Watson, who has filled the post during his absence since 1914, has left to take up a position with the Corporation tramways in Edinburgh.

Mr. J. A. BELL, city electrical engineer, Aberdeen, has been appointed to represent the Institution of Electrical Engineers in the Highland Division of Scotland as adviser in connection with the demobilisation and resettlement of officers in electrical undertakings.

Having been demobilised, Sergt. D. F. HUNTER, V.C., the hero of Moeuvres, is now employed with the Fife Electric Power Co. in their generating station at Townhill.

Mr. W. ADAMS, of Hanley, has been appointed assistant engineer at the Llandudno electricity works, at £160 per annum.

The Bath City Council has increased the salary of Mr. A. B. SHAPLEY, deputy city electrical engineer from £325 to £350 per annum.

General.—It is announced that Mr. E. J. P. BENN has resigned his post as Chief Industrial Organisation Commissioner of the Ministry of Reconstruction. He will continue his work as chairman of the Industrial Reconstruction Council.

Councillor Dr. SHERLOCK has been re-elected chairman of the Dublin Corporation Electricity Supply Committee, and Ald. Farrell deputy chairman.

Mr. A. TOMS, London sales manager of the J. G. Brill Co., has now been released from Government service, and has resumed duties at the London office of the company, 110, Cannon Street, E.C. 4.

Mr. B. H. AULD has resigned his position as director of Messrs. H. T. Boothroyd, Ltd., and is not now connected with the firm.

The directors of the Vulcan Boiler and General Insurance Co., Ltd., and the Inclusive Insurance Co., Ltd., of Manchester, on January 23rd, regretfully accepted the resignation of Lieut.-Col. Sir HAMAR GREENWOOD, Bart., M.P., on his appointment as Under-Secretary of State for the Home Office. Sir Frank Warner, K.B.E., was unanimously elected to fill the vacancy.

Mr. C. G. NOBBS, M.I.E.E., manager and engineer for the Falkirk Iron Co., electrical heating and cooking departments, has received an appointment as manager of the heating and cooking department at the head office of the General Electric Co., Ltd., London. Mr. Nobbs will take over his new duties early in February. Mr. Nobbs's chief duties will be the handling of the designing and constructional work, and principally the commercial organisation for the selling of the products made. It is nearly five years since Mr. Nobbs left the firm of Purcell & Nobbs, London (of which he was partner and manager), to assume his position with the Falkirk Co., whose electrical department he inaugurated in June, 1914. On Friday night, 24th inst., Mr. Nobbs was made the recipient of suitable testimonials and gifts from the electrical department of Falkirk Iron Co., and also from the branch managers, the commercial representatives, and foremen of the firm. Mr. Nobbs indicated there was a big future for electrical heating and cooking, and firms would be well advised to prepare for the coming rush, which, he believed, would come quickly.

Mr. R. J. HOWLEY, M.Inst.C.E., has resigned his position as joint manager of the British Electric Traction Co. in order to take up private practice. Mr. Howley will continue to act as chairman of the Potteries Electric Traction Co. and of the Birmingham and Midland Motor Omnibus Co., and in an advisory capacity to the British Electrical Federation.

Mr. P. J. PYBUS, C.B.E., managing director of the Phœnix Dynamo Co., Ltd., Bradford, took a prominent part in the discussion on the subject of "Christianity and Industrial Problems" at the York Diocesan Conference, last week.

Councillor J. C. WHITE, chairman of the Belfast Corporation Electrical Committee, and a member of the Irish Water Power Sub-committee, has been chosen Lord Mayor of Belfast for the coming year. The Lord Mayor-elect is an authority on Irish water power legal affairs.

Mr. H. JOSEPH, A.M.I.E.E., having been demobilised, has resigned his position with the Urban Electric Supply Co., Ltd., as their engineer and manager at Hawick, and is starting business in Birmingham as the Midland Electric Power Installation Co., and will specialise in electric driving of factories and maintenance and repair of motors. His temporary office is 16, Holly Road, Edgbaston, Birmingham, where he will be glad to receive price lists and catalogues of motors, starters, wiring material, &c.

Mr. W. MCCLELLAND, O.B.E., M.I.E.E., has been appointed Director of Electrical Engineering to the Admiralty, in succession to Mr. C. H. Wordingham, C.B.E., M.I.E.E.

Mr. R. H. CLAMPLETT, who, on the outbreak of war was in business as an electrical contracting engineer, at Cathedral Yard, Manchester, and had been connected with the electrification of a number of textile mills in Lancashire and Cheshire, has recently been discharged from the Army, after serving for over three years as electrician with a technical unit on the Western Front. He resides at present at 350, Colne Road, Burnley, Lancs.

Mr. S. S. MOORE EDE, M.I.E.E., has joined the board of Messrs. Johnson, Matthey & Co., Ltd.

Roll of Honour.—Captain CECIL J. FALK, 7th Battalion, Wilts. Regt., eldest son of Mr. Max Falk, chairman of Falk, Stadelmann & Co., Ltd., has been awarded the Military Cross. He has served in Salonica and France with his regiment for over two years.

Lance-Corpl. C. ORMSBY, R.E., who was an electrician at the Leeds Steel Works, has been awarded the Military Medal for good work on the field of action.

Private C. JACKSON, A.S.C. (M.T.), who was employed in the Leeds Corporation electric lighting department, has been awarded the Military Medal.

Obituary.—MR. F. WARD.—We regret to record the death of Mr. Frederick Ward, manager in England of the Commercial Cable Co. Mr. Ward, who was 68 years of age, passed away very suddenly at Wimbledon on January 23rd. The deceased gentleman was born in 1850. In 1869 he was stationed in Sicily, and in the following year at Aden. He was in Japan as instructor in telegraphy to the Japanese Government from 1872 to 1880, and received the Order of the Rising Sun for services rendered to that Government. From 1881 to 1884 he was with the French Atlantic Cable Co. as superintendent at Sydney, Cape Breton. He joined the Commercial Cable Co. at its inception, and was appointed secretary in Paris to Count Dillon. In 1885 he was appointed superintendent of the Weston-super-Mare and West of England stations. He took the position of manager in England, which he held until his death, in January, 1896. Mr. Ward was also a director of the Halifax and Bermudas and Direct West India Cable companies.

Mr. W. HIBBERDINE.—We regret to record the death, while seated at his desk at Electra House on Thursday morning last week, of Mr. William Hibberdine, O.B.E. The deceased gentleman, who was 63 years of age, had been in the service of the Eastern Telegraph Co. between 40 and 50 years, and was one of the administrative heads (secretary-accountant) of the company.

MR. A. B. LARKINS.—Mr. Arthur Brooks Larkins, late of the Indian Government Telegraphs, passed away in a nursing home in London on January 24th, aged 69 years.

MR. J. H. BUCHANAN.—Mr. J. H. Buchanan, of Edinburgh, a director of the North British Rubber Co., Ltd., passed away last week.

MR. J. E. HOLLAND.—We regret to hear of the death, which occurred on January 23rd, of Mr. John E. Holland, who was the West of England representative for over 36 years of Messrs. Falk, Stadelmann & Co., Ltd. In recent years he has not been quite so active as formerly, and limited his exertions to the larger showrooms which were made in his district.

MR. H. P. J. NEGRETTI.—Mr. Henry Paul Joseph Negretti, of Holborn Viaduct, passed away on January 29th at Hampstead, in his 68th year.

NEW COMPANIES REGISTERED.

Turquand & Kew, Ltd. (152,775).—Private company. Registered January 24th. Capital, £10,000 in £1 shares. Mining and electrical engineers, and manufacturers, &c. Agreement with F. J. Turquand. The subscribers (each with one share) are:—F. J. Turquand, 12, Belsize Park Gardens, N.W. 3, mining and electrical engineer; N. Webster, 17, Marine Square, Brighton engineer. First directors: F. J. Turquand and N. Webster. Registered office: Albion House, 59-61, New Oxford Street, W.C. 1.

C. Redman & Sons, Ltd. (152,684).—Private company. Registered January 20th. Capital, £100,000 in £1 shares. To take over the business carried on by C. Redman & Sons at Pioneer Works, Halifax, and to carry on the business of iron and brass founders, mechanical and electrical engineers, machine tool makers, hardware dealers, &c. The subscribers (each with 100 shares) are:—A. Denton, Derby House, Marple, Ches., machine tool merchant; A. L. Churchill, 9-15, Leonard Street, Finsbury, E.C., machine tool merchant; C. Goodchild, c/o. P. & W. MacLellan, Ltd., 129, Trongate, Glasgow. The first directors are:—A. Denton, A. L. Churchill, C. Goodchild, J. Parker and G. J. Toy. While remaining shareholders, the following have the right to nominate directors in the company, viz.:—A. Denton and Charles Churchill & Co., Ltd., two directors each; and P. & W. MacLellan, Ltd., one director. Registered office: 17, South Street, E.C. 2

Carey-Gavey Syndicate, Ltd. (152,715).—Private company. Registered January 22nd. Capital, £10,000 in £1 shares. Electricians, electrical and mechanical engineers, &c. Agreement with E. S. Carey. The subscribers (each with one share) are:—E. C. Shaw, 39, Gilston Road, S.W. 10; C. Fowler, 1, Chepstow Mansions, W. 2. First directors: E. S. Carey, A. Gavey, Major C. Fowler, and E. C. Shaw (all permanent). Registered office: 9, Orange Street, Haymarket, S.W.

H. T. Boothroyd, Ltd. (99,742).—Capital, £20,000 in £1 shares (15,000 ord. and 5,000 pref.). Return dated December 9th, 1918. 10,002 ord. and 2,800 pref. taken up; £2,802 paid on 2,800 pref. and 2 ord.; £10,000 considered as paid on 10,000 ord. Mortgages and charges: £9,942.

Brown, Boveri & Co., Ltd. (89,167).—Capital, £50,000 in 1,500 "A" and 8,500 "B" shares of £5 each. Return dated January 3rd, 1919. All shares taken up; 15s. per share called up on 8,500 "B"; £6,375 paid; £7,500 considered as paid on 1,500 "A." Mortgages and charges: Nil.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bogota Telephone Co., Ltd. (69,059).—Capital, £45,000 in 20,000 pref. and 25,000 def. shares of £1 each. Return dated November 29th, 1918. 20,000 pref. and 18,607 def. shares taken up; £29,607 paid on 11,000 pref. and 18,607 ord.; £9,000 considered as paid on 9,000 pref. Mortgages and charges: Nil.

Nairobi Electric Power & Lighting Co., Ltd.—Satisfaction to the extent of £1,000 on December 31st, 1918, of debentures dated 1913-15, securing £20,000.

Mersey Power Co., Ltd.—Mortgage dated November 27th, 1918, to secure £300,000, charged on the company's undertaking and property, present and future, including uncalled capital, freeholds, leaseholds, plant, &c. Holders: Ministry of Munitions.

Allies' Electric Lamp Repairing Co., Ltd.—Mortgage debenture for £6,000, dated January 7th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: D. Hogan, 6, Sinclair Road, Kensington.

Musselburgh and District Electric Light & Traction Co., Ltd.—Satisfaction to the extent of £900 on January 7th, 1919, of charge dated November 13th, 1905, and May 11th, 1909, securing £90,000.

C. A. Vandervell & Co., Ltd.—Mortgage on eight houses at Portslade, dated December 31st, 1918, to secure moneys due to National Provincial & Union Bank of England.

Secar, Scott & Co., Ltd.—Particulars of £4,000 debentures created December 5th, 1918, and all issued January 17th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees.

Grimsby Electric Vehicle Co., Ltd.—Debenture dated January 11th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital, to secure moneys due to Barclay's Bank.

Cleveland & Durham Electric Power, Ltd.—Supplemental deed dated December 31st, 1918, securing premium of 3 per cent. on £250,000 first mortgage debentures converted by trust deed of 1913.

Drake & Gorham, Ltd. (70,275).—Capital, £125,000 in £1 shares. Return dated November 27th, 1918. All shares taken up; £85,000 paid; £40,000 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

The Siemens-Schuckert Group.

The Elektrizitats A.G. vorm Schuckert and Co., of Nuremburg, reports that it was impossible for the increase in the receipts in 1917-18 to keep equal pace with the growth in the expenses. The "suspension" of the war had not removed anxiety; on the contrary, a further advance in expenses was rather to be expected, and this would render necessary a fresh increase in the tariffs. The company was abundantly occupied with the preliminary labours in connection with new supply and transport schemes, although it would not be foreseen when these could be carried out under present circumstances. The net profits amounted to £375,000, as compared with £372,000 in 1916-17, and the directors recommend a dividend of 8 per cent. on the ordinary share capital of £3,500,000, being the same rate as in the previous year.

The directors of *Siemens & Halske A.G.*, reporting on the year ended on July 31st, 1918, state that the works were again mainly occupied on the production of electrical manufactures for the Army and Navy, and the deliveries considerably exceeded those in the preceding year. A large stock of orders still remained on the books, but their completion had been jeopardised by intervening events. After setting aside £23,000 for depreciation, as compared with a similar sum in 1916-17, the accounts indicated net profits of £697,000, as contrasted with £643,000, and a dividend of 12 per cent. has been declared, being the same rate as in the previous year. No allocation has been made to the special reserve fund, whereas £100,000 was apportioned to this fund in 1916-17. The sum of £150,000 was granted for the economic relief of the workmen, and the bonuses paid absorbed £90,000, as against £60,000, leaving £63,000 to be carried forward, compared with £64,000 in 1916-17.

The report of the *Siemens-Schuckert Werke* states that the degree of activity in 1917-18 was even greater than in the preceding year, and an improvement also took place in the central station branch, together with continued progress in new connections and extensions of installations in industrial works. Large transformers for 100 volts to 110,000 volts were delivered in considerable numbers, and the 100,000-volt transmission line from Homburg (Palatinate) fully answered the purpose. It was impossible entirely to meet the demand for minor manufactures and meters, so that large stocks of orders had to be brought forward into the new financial year. No details were available concerning the operations of the oversea offices and companies. On the other hand, business with neutral countries experienced an increase. The Siemens-Schuckert group subscribed £6,300,000 to the recent war loans, whilst the contributions made by the company and the Siemens & Halske Co. towards the relief of the officials and workmen amounted to £230,000. The accounts show the following results:—

	1916-17.	1917-18.
Share capital	£4,500,000	£4,500,000
Terminable loans	3,784,000	3,732,000
Perpetual loans	2,500,000	2,500,000
Gross profits	1,309,000	1,328,000
General expenses	122,000	144,000
Interest charges	333,000	332,000
Depreciation	74,000	78,000
Net profits & balance forward	793,000	791,000
Transferred to reserve	125,000	125,000
Bonuses	100,000	150,000
War benevolent grants	75,000	—
Dividends	450,000	450,000
Dividend per cent.	10	10
Carried forward	18,000	41,000

According to the balance sheet, the company's credit at the banks on July 31st, 1918, amounted to £4,125,000, as compared with £4,200,000 on the corresponding date in 1917; the securities in portfolio represented £1,700,000, as against £590,000, and stocks and installations in course of construction were entered at £7,025,000, as contrasted with £5,150,000. This increase is attributed to uncompleted orders from 1916-17, and to new orders received in the past year. The report states that owing to the abandonment of the Brest-Litowsk Treaty the obligation of the Russian Government to pay compensation for the State acquisition of the Russian Siemens-Schuckert works was "interrupted"; nevertheless hopes were still entertained of obtaining adequate compensation.

The Constantinople Telephone Co.

Mr. J. E. Kingsbury, director and representative in the United Kingdom of this company, has circulated from his office at 7, Serjeants' Inn, Temple, London, E.C. 4, the following circular, placing the position of the company before the share and bondholders:—

On May 7th, 1915, a circular letter was addressed to you stating that the Turkish Government had forcibly taken possession of the company's system in Constantinople; that the general manager and the British staff had returned to England; and that a letter had been received from Mr. Salem, the company's chief legal adviser in Constantinople, with a copy of the protest addressed by the Constantinople directors to the Turkish Government. . . . . The directors in London and Paris have taken the necessary steps to place the facts of the company's case before the British and French Governments, and to claim their assistance on behalf of the Allied investors. Through the active assistance of the Foreign Office and the War Office . . . . arrangements were made, immediately after the armistice with Turkey, for the general manager, Mr. Douglas Watson, with five expert assistants, to proceed to Constantinople to place their experience at the disposal of the British authorities, and to be available to take over the plant at such time as its restoration to the company could be effected. Mr. Watson, with his party, arrived at Constantinople on December 2nd, and information has now been received from him that the plant has continued in operation throughout the period of the war, and still continues in operation, though with an imperfect service arising from deficiency of certain plant and lack of efficient management and organisation. Mr. Salem is now on his way from Paris to Constantinople, and on arrival will confer with the general manager as to the steps which should be taken for the recovery of the property, and to obtain reparation for the losses which the company has sustained at the hands of the Turkish Government. The European directors are taking every possible step to obtain a just settlement of the company's claims, but are, of course, unable to forecast either the time or the basis of such settlement. So soon, however, as any further definite information is obtained, they will have pleasure in communicating it to you. . . . As the company is incorporated under Turkish law, no registration of transfers in London can be effected until the restrictions resulting from the war conditions are removed.

Melbourne Electric Supply Co., Ltd.

Gross profit during year ended August, 1918, from the Melbourne and Geelong undertakings £161,887, against £151,304, an increase of 7 per cent. After paying expenses, debenture interest, &c., £3,408 has been written off capital expenditure, and £14,000 off cost of gold bond issue; £20,000 is reserved for income-tax and excess profits duty, and £15,000 is put to general reserve, raising it to £115,000. The 7 per cent. pref. dividend is paid, and a total of 10 per cent., free of British tax, on the consolidated ordinary stock, leaving £2,033, plus £72,817 brought in. The uncertainty due to war conditions having in a great measure disappeared, the carrying forward of a large credit balance is no longer required.

In view, however, of the necessity for making provision for the redemption of the 6 per cent. five-year gold bonds, 1922, issued in the United States in March, 1917, for the purpose of financing the company over the war period, the directors have created a gold bonds redemption account, and have allocated thereto £50,000, made up of £10,000 hitherto standing to the credit of dividend equalisation account which the directors consider is not now required, and £40,000 transferred from the available credit balance of £74,849. This leaves a net credit balance of £34,849 to be carried forward. With a view to making timely provision for future requirements, the

directors have applied to H.M. Treasury for permission to issue a further £9,000 7 per cent. cumulative preference shares of £5 each, and also the small outstanding balance of £11,319 consolidated ordinary stock.

The following tables show the progress of the company's business:—

	Year ended August, 1917.	Year ended August, 1918.
MELBOURNE—		
Number of consumers	32,142	36,870
Lighting, &c., in KW.	27,583	31,740
Motors in H.P.	23,718	27,640
Total connections in KW.	51,309	59,380
Total units sold	28,385,000	32,839,227
GEELONG (including tramways)—		
Number of consumers	2,845	3,148
Lighting, &c., in KW.	2,643	2,843
Motors in H.P.	2,294	2,392
Total connections in KW.	4,937	5,235
Total units sold	1,505,941	1,677,770

The increase in new consumers in Melbourne was 15 per cent.; in power supply 16 per cent.; in total connections 15 per cent.; total units sold 15 per cent.; gross revenue 17 per cent.

Adelaide Electric Supply Co., Ltd.—Gross revenue for year ended August, 1918, £174,254, against £154,451, an increase of 13 per cent. After paying expenses, paying debenture interest, &c., reserving £7,500 for income tax and excess profits duty, paying the 6 per cent. preference dividend, and a total dividend of 12 per cent. for the year, free of British income-tax on the ordinary shares, £16,942 is to be carried forward, including £10,800 brought in. Out of the balance of premium account £1,746 is put to writing down cost of investments, and £20,000 is put to general reserve, raising it to £80,000. The progress of the last year appears in the following figures:—

Year ended	Consumers.	Lighting, in KW.	Motors, in H.P.	Total connections, KW.	Units sold.
August, 1917 ...	19,590	14,420	10,221	24,641	9,330,495
August, 1918 ...	21,917	15,856	11,351	27,207	10,775,934

The number of consumers increased by 12 per cent.; power supply by 11 per cent.; total connections by 10 per cent.; total units sold by 15 per cent.; gross revenue by 13 per cent. The £50,000 consolidated debenture stock, 6 per cent., free of British tax, was offered in Australia last July; the whole was applied for and has been paid up in full.

French Companies.

The report of the *Société d'Electricité de Paris* states that the supply of coal proceeded in a fairly regular manner in 1917-18, both in regard to British coal and that from the Pas de Calais, although prices remained extremely high, and Government measures prevented the company from exercising initiative and experience in effecting purchases. This system would probably continue for a certain time after the end of the war. Owing to excessive wear and tear of the plant and machinery it had been necessary to make arrangements for substitutes, notwithstanding the present prices, and orders had therefore been given for some new sets. The sales amounted to 150,000,000 KW.-hours, as against 154,000,000 KW.-hours in 1916-17, the reduction being due to a decrease in sales to the underground electric railways during the period when a portion of the population left Paris owing to aerial raids and the activity of long-range guns. As net profits the accounts show the sum of £102,000, which has permitted of the payment of a dividend at the rate of 8 per cent.

The Compagnie d'Electricité de l'Est Parisien, reporting on the year ended on June 30th, 1918, states that the directors had been successful in obtaining from manufacturing consumers modifications of the supply contracts, so as to compensate to some extent for the growth in the cost of production owing to the dearness of coal and other raw materials. At the same time, it had been possible to secure similar alterations in the contracts with the municipal authorities, as a result of the approval given by the Prefect of the Seine in November, 1918, and the directors pay a tribute to the spirit of conciliation manifested by the municipal councils in this direction. The latter changes would have retroactive effect to April, 1915. The working receipts in 1917-18 amounted to £631,000, as compared with £430,000 in the previous year, but as the working expenses greatly increased, and reached £641,000, there was a loss of £10,000, which, with interest charges, interest on loans, &c., rose to £59,000. The compensation to be received under the concessions made by the local authorities, however, would permit of the extinction of this debit balance, and of the deficit of £15,000 which took place in 1916-17. It is added that the average price of coal advanced from £3 18s. 4d. per ton in 1916-17 to £5 7s. 2d. last year. The generating station at Alfortville was on the point of starting a new turbine of 6,000 KW., and new boilers were to be installed in addition to two boilers which had just been erected.

The report of the *Société Industrielle des Téléphones*, whose accounts for 1917-18 were referred to in our issue of January 3rd, states that the turnover experienced a further increase, notwithstanding the difficulties in obtaining coal and other raw materials and the necessary labour, the company having in this way contributed towards the national defence by supplying cables, apparatus, &c., for the Army and Navy. The financial results were satisfactory, despite a reduction in the net profits as compared with the previous year, owing to the tax on war profits having been raised from 70 to 80 per cent., and the directors were able to propose a dividend of £1 12s. per share, as in 1916-17. After providing for this distribution the sum of £52,000 has been placed to the contingency reserve fund, which would be all the more necessary, as the price of money after the war would certainly continue high, and as considerable funds would be required for repairs and for the development of the works. During the past year a new building was erected at the company's telephone works in the Rue des Entrepreneurs, which was the first step in the execution of the scheme for the expansion of manufacturing. The other portions of the programme, which had to be deferred having regard to the wishes of the Government, were ready, and would be carried out as soon as circumstances would permit. Numerous aerial bombardments of the works at Calais had taken place, but the personnel remained immune, and the material damages were not of much importance. The directors had facilitated the formation of a co-operative food supply company in connection with the Bezons works, and the satisfactory results obtained were now leading to the constitution of a similar company for the personnel at the Paris works. The sum of £14,000 was applied to the relief of mobilised workmen and their families, being the same amount as was allotted to this purpose in the preceding year.

Puebla Tramway, Light & Power Co.—Net profits for the year ended December 31st, 1917, £52,604, against £10,672. The power plants have been efficiently maintained, and regular services have been afforded to Puebla and to the Vera Cruz Electric Light, Power & Traction Co. Progress has been made with the reconstruction of the San Raphael transmission line, but local conditions will postpone the completion of the work for some time. The tramway service to Huejotzingo has been suspended temporarily for a few months, owing to disturbances in outlying districts.

East London Railway Co.—The report states that the passengers carried during 1918 were 10,564,306 (plus 1,222,000 season ticket journeys), against 9,189,476. Net income, £35,669, plus £991 brought forward. After making debenture interest appropriations £9,586 is carried forward.

British Trade Corporation.—The profits for 1918 were £71,589, plus £9,671 brought forward. Dividend of 5s. per share, less tax; preliminary expenses written off, £10,204; depreciation on furniture, &c., written off, £4,385; carried forward, £14,252.

London United Tramways, Ltd.—A meeting of the holders of the mortgage debenture stock approved last week the scheme of arrangement between the company, the holders of preference shares, mortgage debenture stock, and second and third debentures of the company.

Westminster Electric Supply Corporation, Ltd.—Dividend on ordinary shares for the December half-year at the rate of 9 per cent. per annum, making 8 per cent. for the year, against 9 per cent. for 1917.

STOCKS AND SHARES.

TUESDAY EVENING.

THE labour situation dominates everything in the industrial market, besides having a pronounced effect upon Home Railway stocks. In spite of this, however, there is a good deal of business doing in the Stock Exchange. Prices keep up well, considering the various influences adverse to employment of capital. The weather conditions have also played their part in the way of interrupted communication with the provincial centres, where so much of the money lies, and from which so much of the speculative enterprise emanates. The exasperation produced by the Government offer of National War Bonds is passing away, and there is brisk demand for all securities of the best order.

The various strike developments of the early part of the week were held at first to be indications that the epidemic was dying out, but it soon became clear that this was not the case, and in consequence a slight revival in Home Railway stocks was followed by further reaction. This has affected Undergrounds with the rest. Districts shed 1¼, Metropolitans ¼, Underground Income Bonds a point, and the £10 shares 10s. The 1s. shares of the last-named company keep steady at 11s., although this, of course, is not anything like the top recently reached. What interest there was in dividend announcements has been damped by the first declarations from the leading steam companies. Apparently, railway directors prefer to act cautiously in the face of labour difficulties. The East London report appeared a few days ago, but furnishes slender information. It shows that traffic has increased considerably, both from season-ticket and ordinary travellers. Meanwhile, the price of the company's stocks show little variation, the "A" and "B" debentures being about 68¼ and 40 respectively, while the two junior stocks stand at 19 and 12. The "B" debenture stock has changed hands several times this week on the basis of the price just quoted. The dividend for 1918 was, of course, 10s. per cent., as against the full 4 per cent. to which it is entitled.

Home electricity shares have not moved one way or the other. There is not much business doing in them, and pending the declarations of the next dividends, interest can hardly be expected to revive. The companies are touched nearly by coal considerations, and, having regard to the

various threats of strikes, it is natural enough that prospective buyers should hold their hands until the outlook becomes clearer. Interest is being diverted from home industrials generally to those of colonial and foreign companies, which are at present less under the influence of strike threats, but although many shares in the various groups concerned have appreciated during the past week, this factor has not helped the Argentine and Brazilian traction descriptions. Anglo-Argentine Tramways preference are both decidedly lower. Prices recovered after the revolution in Buenos Aires had been composed, though they failed to regain fully their previous losses, and the market again shows a dwindling tendency. Brazilian Tractions are down ½, and the dulness in the British Columbia Electric Railway group is still apparent, the 5 per cent. preference stock shedding a point. Mexicans are also out of favour, and a dollar fall in Mexican Light & Power common shares reduced the price to 37. Meanwhile the Colonial companies are doing well, and the report of the Adelaide Electric Supply Co. shows the gross revenue increased by 13 per cent., and the final dividend, making 12 per cent., free of tax, for the year, was paid in December.

Telegraphs and Telephones are very quiet. Marconis have rallied ½. Manufacturing shares show some irregularity. British Aluminiums and Electric Constructions went back a trifle. A Stock Exchange rumour says that the General Electric Co., Ltd., or Fraser & Chalmers, is taking an interest in one of the well-known Colombian mining companies. British Westinghouse preference are a harder market at 2 9/16. In the engineering list, Babcocks lost the 2s. 6d. they gained last week. We have added Siemens to our list of prices; there is a good deal of business doing in the shares. The rubber market has quieted down somewhat after its buoyancy and excitement. Base-metal issues are attracting no particular attention.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Jan. 28, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	7½	—	£6 15 7
Charing Cross Ordinary	5	4	3⅝	—	5 10 4
do. do. do. 4½ Pref.	4½	4½	3½	—	6 8 7
Chelsea	3	5	4	—	6 5 4
City of London	8	8	13½	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
Kensington Ordinary	6	7	6	—	5 16 8
London Electric	Nil	Nil	1⅝	—	Nil
do. do. 6 per cent. Pref.	4	5	4	—	6 5 0
Metropolitan	3	4	3	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	3½	—	6 16 6
St. James' and Pall Mall	8	9	7½	—	6 4 2
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	7½	—	6 2 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	98½	—	6 1 10
do. Def.	1½	1½	22	—	7 12 0
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15½	—	*5 3 3
Eastern Tel. Ord.	8	8	157½	+ ½	*5 1 7
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	24	22	32	— ½	6 17 6
Indo-European	13	13	58½	—	5 11 0
Marconi	15	20	4⅝	+ ⅛	4 6 7
Oriental Telephone Ord.	10	10	2½	—	4 0 0
United R. Plate Tel.	8	8	7¼	—	*5 1 7
West India and Panama	6d.	1/3	1⅜	— ⅛	*8 17 6
Western Telegraph	6	6	16⅜	—	*4 16 8
Home Rails.					
Central London Ord. Assented	4	4	65½	—	6 2 2
Metropolitan	7	7	30½	— ½	5 5 6
do. District	Nil	Nil	27⅛	—1½	Nil
Underground Electric Ordinary	Nil	Nil	3½	— ½	Nil
do. do. "A"	Nil	Nil	11/-	—	Nil
do. do. Income	6	4	92½	—1	*4 6 6
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3⅞	— ⅛	—
do. do. 2nd Pref.	5½	—	3½	— ½	—
do. do. 5 Deb.	5	5	71½	—1	6 19 10
Brazil Tractions	—	—	85½	— ½	—
Bombay Electric Pref.	6	6	10⅝	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	66½	—1	7 8 2
do. do. Preferred	Nil	Nil	48	—	Nil
do. do. Deferred	Nil	Nil	45	—	Nil
do. do. Deb.	4½	4½	62	—	6 17 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	66	—	Nil
do. 6 per cent. Bonds	Nil	Nil	82	—	Nil
Mexican Light Common	Nil	Nil	37	—1	Nil
do. Pref.	Nil	Nil	48	—	Nil
do. 1st Bonds	Nil	Nil	69½	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	9⅞	— ½	3 17 5
British Aluminium Ord.	10	10	1¹¹⁄₁₆	— ⅛	5 8 5
British Insulated Ord.	20	20	2½	—	4 9 0
British Westinghouse Pref.	7½	7½	2⅝	— ⅛	6 0 0
Callenders	20	25	11	—	5 13 8
do. 6½ Pref.	5	5	5⅜	—	5 3 4
Castner-Kellner	22	20	9⅞	—	4 16 3
Edison-Swan, "A"	—	—	20/-	—	7 10 0
do. do. 4 per cent. Deb.	4	4	74½	—	5 6 0
Electric Construction	7½	10	1⅜	— ⅛	8 8 5
Gen. Elec. Pref.	6	6	10½	—	6 6 10
do. Ord.	10	10	17½	—	*5 12 8
Henley	25	25	9½	—	5 11 3
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 16 0
Siemens Ord.	10	—	6⅞	—	*7 17 1
Telegraph Con.	90	90	48	—	*5 0 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, January 29th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/5	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	"	£75	£1 inc.
a Bisulphide of Carbon	"	..	..
a Borax	"	£43	..
a Copper Sulphate	"	£60	..
a Potash, Chlorate	per lb.	2/-	1d. dec.
a " Perchlorate	"	1/9	..
a Shellac	per cwt.	£14	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	"	£23	..
a " Lump	"	£25	..
a Soda, Chlorate	per lb.	10½d.	..
a " Crystals	per ton	17½/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2' to 12' basis)	per lb.	1/1½	..
c " Tubes (solid drawn)	"	1/3½ to 1/4	..
c " Wire, basis	"	1/2	..
c Copper Tubes (solid drawn)	"	1/6½	..
g " Bars (best selected)	per ton	£132	£2 dec.
g " Sheet	"	£132	£3 dec.
g " Rod	"	£132	£3 dec.
d " (Electrolytic) Bars	"	£105	..
d " Sheets	"	£161	..
d " Wire Rods	"	£115	..
d " H.C. Wire	per lb.	1/1½	..
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	11/-	..
h India-rubber, Para fine	"	3/6	..
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£40	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	9d. to 4/6	..
e " " " medium	"	5/- to 10/-	..
e " " " large	"	12/6 to 25/- & up.	..
d Silicium Bronze Wire	per lb.	1/7	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	£243	£7 dec.
n " Wire, Nos. 1 to 16	per lb.	4/-	3d. dec.

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
r W. F. Dennis & Co.

High C.P. Searchlights.—The *E.T.Z.* states that a German experimenter has experimented in order to increase the specific surface luminosity of the searchlight arc lamp, and has been able to attain a searchlight efficiency of five times that hitherto obtained, with the same power consumption and optical arrangements. Instead of using the ordinary 38 mm. diameter pure carbons, he employed high-efficiency carbons of 11 and 16 mm. Opposite the horizontal positive carbon is arranged obliquely upwards the negative, which is 11 mm. dia. The carbon ends are played upon by a flat spirit flame, which cools the incandescent ends of the carbons, and the passage of the current is no longer limited to the ends, but reaches the inner parts of the carbons. This causes considerable increase in temperature of the carbon crater, and the latter burns very deeply into the thin carbon rod, giving a small, round, and intensely bright crater opening which, when projected, appears as a circular luminous disk, and has a much higher specific luminous intensity than the usual large, but flat, crater in the ordinary type of projector. The energy is much better used, as the voltage with a current of 150 amps. reaches 75 to 80 volts. In practice the carbons are kept constantly in rotation by a small electric motor in order to ensure even burning. To ensure the crater of the positive carbon keeping in the focus of the parabolic mirror, the carbon is adjusted by an electromagnetic device with the aid of a selenium cell. Experiments made by Prof. Wedding show the candle-power of such searchlights to attain 500 million C.P.

A New D.C. 3-wire Meter.—The Sangamo Electric Co., Springfield, has just produced a D.C., three-wire meter consisting of two standard two-wire elements placed side by side on a common base and recording on a common recording train, so that the sum of the revolutions of the two elements is indicated on the dial of the meter. This is effected by a differential gearing, and the arrangement is such that the total revolutions of the two movements are correctly recorded, no matter how the load is divided between the two sides of the three-wire system. It is claimed that this meter is the first one to read correctly even if one side of the system is dead, and if the neutral wire is opened. Illustrations and diagrams are given in *Electrical Review and Western Electrician*, November 9th, 1918.

ELECTRICITY ON BOARD SHIP.

UNTIL recent years the application of electricity to the operation of the various devices on board ship has been slow. This has been true of marine work generally. The most conspicuous exception to this rule has been in the American Navy, which is not only a larger user of electrically-driven machinery than the merchant service, but also leads the navies of the world in the application of electricity to the almost countless devices used on board a modern battleship. The employment of electricity on ship-board was at first limited to illuminating purposes and searchlights. Since about 1898 the use of electricity has been extended, until to-day some of the largest and most powerful super-dreadnoughts and battle cruisers in the U.S. Navy are electrically driven. As illustrations of this the cases may be cited of the super-dreadnoughts U.S.S. *Tennessee* and *New Mexico*, which have displacements of 32,600 tons, and are designed for speeds of 21 knots (see ELEC. REV., September 14th, 1917, and May 10th, 1918). The first ship of any importance, excepting submarine boats, in the American Navy, to be electrically driven was the U.S. collier *Jupiter*, which was built at the Mare Island Navy Yard and placed in commission in 1913 (see ELEC. REV., November 27th, 1914, September 10th, 1915, January 14th, May 5th, 1916, and March 9th, 1917.)

The electrical installation on board a modern battleship may be divided into three general systems—power, lighting, and signalling. Outside the main drive, which usually consists of standard A.C. steam turbo-alternators similar to those in use in large power houses, the power plant generally comprises a number of 300-KW. turbine-driven, 125 or 250-volt, direct-current generators to furnish current for exciting the alternators and for light, power, signals, and the several hundred motors used about the ship. The generators of the earlier equipment were direct connected to the turbines, ran at a speed of 1,500 R.P.M., and were of the compound-wound type with commutating poles. In the more modern equipment geared turbines are used, and the generators operate at from 700 to 1,000 R.P.M. On account of the comparatively heavy current and small diameter of commutator, the 125-volt units generally have two commutators, one at each end of the armature.

It is general practice to provide not less than four of these sets, and to locate them in two separate dynamo rooms, so that in case of the disablement of one dynamo room the entire electrical equipment will not be put out of action. The method of operating the alternators varies somewhat with different nations. In America it is general practice to operate them in parallel, while in Europe in many cases the generators are arranged so that the distributing circuits can be transferred from one generator to another, but the generators cannot be operated in parallel. The switchboards used for the control of the D.C. power plant on a modern battleship are arranged as follows:—On the centre panels are mounted the switches, circuit-breakers, instruments, &c., for the control of two generator sets, either or both of which may be connected to the bus-bars. The end panels are for the control of the distributing circuits. Circuit-breakers are used to protect the large-capacity circuits, while fuses are used on the smaller circuits. Where the power plant is divided and located in separate rooms, two lines are provided between the different switchboards. In addition to the main switchboard, other distributing panels are located in various parts of the ship for the control of motors and to distribute to the various equipments.

In America the earlier practice was to construct the switchboard panels of slate mounted on angle-iron supports, and sometimes cushioned with rubber to prevent breakage. The more modern practice is to construct the panels of non-fragile insulating material, such as asbestos or timber. In Europe the panels are frequently made of steel, with the instruments insulated therefrom.

One of the most important applications of electricity on board ship is to the steering gear. Although electrical steering gears have been given attention for some 20 or 25 years past, it is only within recent years that they have been adopted in general. At first they were applied in conjunction with steam engines, the electrical drive acting as an auxiliary. One of the first systems to be successfully employed utilised a motor-generator set to supply power to a shunt motor for operating the rudder. Control with this system was effected on the Wheatstone bridge principle, and is known as the "Pfatischer" system, one arm of the rheostat being located at, and operated from, the steering stand, and the other located at, and operated by, the rudder. This system followed along the idea of the old follow-up system of the steam engine; that is, the helmsman set the steering wheel at the angle it was desired to have the rudder moved to, and when the latter arrived at that position it automatically cut out the source of driving power.

Quite a number of United States battleships and cruisers are equipped with a rheostatic system of control on the steering gear. The motor is fed directly from the ship's mains, thus obviating the use of a motor-generator set. In this system the motor is controlled by a contactor panel, which is equipped with contactors for reversing the motor, cutting out the armature resistance, for operating at low speeds, and for dynamic braking. The controller and starting resistance are usually placed near the motor, and operated from a steering stand at the steering stations in different parts of the ship. The helmsman can always tell the position of the rudder by a helm-angle indicator placed near the steering stand. To prevent the rudder from jamming on the hard-over positions, limit switches are provided.

The system which is now receiving favourable consideration makes use of a hydraulic mechanism to operate the rudder. A variable-speed hydraulic pump delivers oil to large rams connected to the rudder cross-head, and this pump is driven by a constant-speed motor, which is started up and allowed to run continuously. A small pilot motor operates the valve of the hydraulic pump, and the control of this pilot motor, from various stations in the ship, is the same as the rheostatic system previously described. This hydraulic-electric steering gear is being installed quite generally on large U.S. naval vessels. Its principal point of advantage is that it substitutes the hydraulic variable-stroke pump and hydraulic ram for the very inefficient screw gear arrangement previously used on the older vessels, and therefore permits the installation of a relatively small motor for driving the rudder. The requirement on nearly all naval vessels is that the motor must operate the rudder from hard-over to hard-over in 20 seconds; on the most recent vessels it has been modified in some cases to 30 seconds. With the rheostatic control on the larger battleships, compound-wound interpole motors of 300-H.P. capacity are required to operate the steering gear, while with the hydraulic-electric system the horse-power is reduced to about 150, or one-half. The motors are fitted with disk brakes on the armature shaft, which, assisted by dynamic braking, bring the rudder to rest.

Another service that requires large motors is the anchor windlass; on some of the recent equipment installed on U.S. battleships, two motors are used, each having a one hour rating of from 125 to

150 H.P. The motors are compound-wound and equipped with commutating poles and a disk brake, and are coupled direct to the worm gears through which the windlass is operated. The motors can be operated independently, as well as two simultaneously in series or parallel. The equipment is capable of raising two 20,000-lb. anchors simultaneously, and 360 ft. of chain on each, each chain weighing about 36,000 lb., at the rate of 36 ft. per minute.

The cranes for handling the lifeboats are operated by compound-wound motors, usually of 50 H.P. capacity. The requirements are that this equipment shall raise a load of 40,000 lb. at 20 ft. per minute, and the empty hooks at 60 ft. per minute. An electric brake is fitted to the motor, so that it will hold the load should the power fail. A motor is also used for rotating the crane, so as to place the boats in position on deck; this motor is frequently of 50-H.P. capacity. Winch motors for both coal and cargo are 35 to 45 H.P. in size, compound wound, and fitted with inter-poles. The winches for coal-handling can generally handle a 5,000-lb. load at 200 ft. per minute, and a 20,000-lb. load at 50 ft. per minute.

Forced ventilation is an important feature on modern battleships; on large ships the ventilation system may consist of over 100 electrically-driven fans, handling 500,000 cu. ft. of air per minute. The motors vary in size from 1 to 15 H.P., and in addition there may be as many as 200 small disk or bracket fans in use. In the latest practice on battleships steam turbines are used extensively for driving the ventilating fans. Electrically-driven pumps are used for various purposes, such as fire, and fresh-water supply, bilge, drainage tanks, sanitary purposes, refrigeration, &c. These motors vary from 1 to 75 H.P. in size. Some 15 to 20 pumps are supplied to handle the bilge water, which require vertical and horizontal motors from 25 to 75 H.P. in size. Motors are used for turning the turrets, elevating the large guns, and hoisting the ammunition. These services require motors ranging in size from 3 to 35 H.P. Variable as well as constant-speed motors are used on the ammunition hoists.

Electricity is used for almost every imaginable purpose on board the modern ship; the completeness of the equipment is evident from such items as moving-picture machines, cake mixers, ice-cream freezers, &c., which would indicate that almost all the luxuries that may be had on land are also provided on board ship.

The illuminating equipment of a battleship consists of from 3,000 to 4,000 lights; incandescent lamps are almost exclusively used, and the fixtures are of special design to make them water-tight, and also on account of the vibration of the ship. The cables must also be of a special design to resist moisture; on American ships they are insulated with a high-grade rubber and suitable braid, and then protected with a lead sheath and metal armoured, while in the British Navy ordinary commercial standard, stranded, paper-insulated and armoured cable is used throughout on the ring-main system. Rubber insulation was abandoned some years ago. The electrical installation on a battleship requires from 75 to 100 miles of cable.

The signalling apparatus is a very extensive part of the electrical equipment, consisting of some 40 different systems, including ammunition-hoist indicators, turret telephones, gun-firing, fire-control, and engine-room telegraphs, fire alarms, torpedo-firing, wireless telegraph, &c. A number of these equipments are installed in duplicate, and are supplied with power from two sources. The systems operate on pressures ranging from the voltage of the power circuits down to 15 volts, used for call bells. Both A.C. and D.C. are used, the former and low-voltage D.C. being obtained from motor-generator sets.

One of the most interesting pieces of electrical apparatus on a ship is the Sperry gyroscopic compass (see ELEC. REV., June 6th, 1913). This has completely displaced the magnetic compass on the larger vessels and submarines of practically every navy in the world. Another interesting and important device is the high-intensity searchlight (see ELEC. REV., September 8th and December 15th, 1916). The size used on ships is 36-in. diameter, and throws a beam 40 miles, its candle-power is 320,000 per sq. in., and it has a beam intensity of 250,000,000 C.P. It has been reported that signals flashed with such a searchlight of 60-in. diameter were seen 150 miles away.

The arm of the Navy that is attracting more attention than any other at the present time is the submarine (see ELEC. REV., July, 1915). Each propeller shaft of a modern submarine is operated by an oil engine or motor, according to the conditions of operation, the oil engines driving the motors as generators while on the surface, and charging storage batteries, which in the submerged condition supply energy to the motors to drive the propellers. The main motors are of large size, varying from 500 to 800 H.P., and even larger, according to the size of the boats, and they are remotely controlled by automatic-contactor controllers from a central station. Each motor may consist of two units or a single unit, according to conditions. In addition, each submarine is provided with a large number of auxiliary motor equipments for operating pumps, air compressors, steering gears, diving gears, periscope-lifting gears, &c.; the horse-power of these auxiliary motors varies from 0.5 to 50 or 60 H.P., and the majority of them are operated by contactor push-button controllers. Submarines are also equipped with electric lighting, cooking, and heating devices, and complete sets of wireless and other signalling apparatus.

In addition to what has already been done, the American General Electric Co. has contracts for machinery for three battle cruisers of 32,000 tons displacement and 180,000 shaft H.P., and it is building electric propelling machinery for two cargo vessels, each of which equipments will deliver 3,000 shaft H.P. Some of the ship equipments are by far the largest ever made; each of the eight motors on one of the battle cruisers has four times the capacity of the largest motor previously built.

IRON AND STEEL ELECTRIC FURNACES.

BY J. BIBBY.

(*Abstract of paper read before the* MANCHESTER ASSOCIATION OF ENGINEERS.)

THE subject of the reduction of iron ore is not without interest to this Association, as recent improvements in the reduction of iron ore electrically have come from this country, and the furnaces themselves, together with the electrical equipments, are mainly manufactured in the Manchester district.

On the average a blast furnace consumes one ton of coke per ton of pig iron produced. The electric furnace consumes one-third of a ton of coke, and requires one-third H.P.-year per ton of pig produced. For the cost of the two systems to balance, 1 H.P.-year must be supplied at the cost of two tons of coke. In many countries the balance is in favour of the electric system; there are already 17 electric reduction furnaces working, and 18 others are now being installed in Italy and Japan.

Electric pig-iron is a superior product to that from a blast furnace, chiefly because only one-third of the impurities are introduced by the fuel, and it is possible to maintain a basic highly fluid slag in the melting chamber, which facilitates the extraction of the sulphur; also electric pig-iron does not contain the oxides produced by the blast in an ordinary furnace. Fig. 1 shows the general arrangement of an electric reduction furnace, which to a large extent resembles an ordinary blast furnace.

There is a shaft and charging gear on identical lines with the blast furnace. In the electric furnace we have a hearth which is three or four times the diameter of the bottom of the shaft, which constitutes the melting and crude refining

chamber. In the electric furnace the whole of the heat necessary for the process is generated electrically. The ore is fed through the usual bell and hopper arrangement at the top of the furnace, together with lime for slagging the gangue and coke solely for reduction. The whole of the reduction takes place through the affinity of oxygen for carbon being greater than its affinity for iron at certain temperatures.

Between temperatures of, say, 250 deg. C. and 500 deg. C. reduction of iron ore takes place as follows:—

$$Fe_2O_4 + CO = 3FeO + CO_2.$$

At temperatures between 500 deg. C. and 800 deg. C. the ferrous oxide is reduced by solid carbon as follows:—

$$FeO + C = CO + Fe.$$

The CO produced lower down the shaft is used for the reduction of the higher oxides further up.

The iron produced is in sponge form, and gravitates down to the crucible together with the lime and gangue; the crucible is not completely filled, but there is a space between the angle of repose of the material and the annular crucible roof. Into the material a number of electrodes are embedded, and these pass through holes in the crucible roof. On small furnaces of 2,000 H.P. there are four electrodes, on

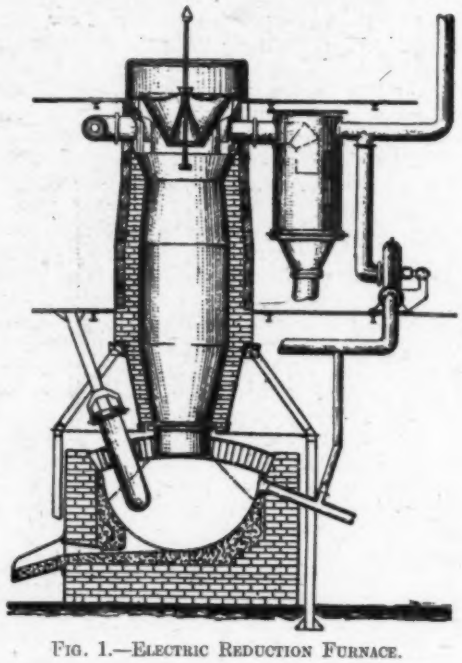

FIG. 1.—ELECTRIC REDUCTION FURNACE.

medium size furnace of 4,000 to 6,000 H.P. six electrodes, and on larger furnaces of 8,000 to 10,000 H.P. eight electrodes.

The furnace comes under the class of solid resistance furnaces. For metallurgical reasons it is important that the heat should be generated throughout the circular zone as uniformly as possible, for unless this is accomplished we shall have undue destruction of the lining where there is an excess of heat, and where there is too little heat a deficiency in slag melting. This is a matter of the greatest importance.

Considering first the case of four electrodes, we naturally employ the Scott connection, in which the terminals of each transformer are connected to diagonal electrodes. In this case, whilst we get equal voltages between the two pairs of diagonal electrodes, it does not follow that the voltages between adjacent electrodes are equal; in fact, there is no reason why there should be any voltage drop between electrodes 1 and 4, and in that case no current, and therefore no heat would be generated there. The voltages between electrodes 1 and 4 and 4 and 3 will be equal, and equal quantities of heat will be generated between these two points, but the voltage between electrodes 2 and 3 will be 1.4 times the voltage between electrodes 1 and 2, and since the distances, and therefore the resistances, are the same, the currents, and therefore the heats generated, will be above the normal.

As the later furnaces became larger it was necessary to employ more electrodes, because, for one reason, up to the present the largest electrodes will only take about 1,000 KW. each, so we had to devise a system where eight phases could be secured in such a manner that the phases were at 45 deg. to each other. This was accomplished by a simple static transformer system which produces the heating effects shown in fig. 2.

The resistance in the crucible varies within wide limits, and it was therefore necessary to have tappings on the transformer which gave voltages varying from 20 to 50 between the electrodes and the neutral. No attempt is made to regulate the current, but all regulation is done on the voltage. The electrodes are not regulatable in the ordinary sense, but are simply dropped a few inches further into the material every few days. The electrode consumption is only about 6 lb. per ton of pig iron produced. Amorphous carbon electrodes have up to the present been used exclusively.

Practically the whole of the gas in the electric furnace is produced from the oxygen of the ore and the carbon in the fuel. There is no external gas supply as in the blast furnace, consequently the total amount of gas passing away is only about one-eighth of that from a blast furnace, but it has a calorific value from two to three times that of blast-furnace gas. This richness of the gas is valuable for heating purposes, and also for power, since engines of the same cylindrical dimensions will develop about 25 per cent. more power with electric-furnace gas than with blast-furnace gas. Another feature of the electric furnace is that about two-thirds of the gas issuing from the top of the shaft is re-introduced into the crucible between the charge and the roof. This gas passes through a dust extractor, washer, and dryer, and the circulation is produced by a regulatable fan. Every particle of gas generated, therefore, passes three times through the furnace. The object of the circulation is to cool the roof of the crucible and to convey the heat into the shaft, so that the material may be raised to a reducing atmosphere at about two-thirds the height from the bottom of the shaft.

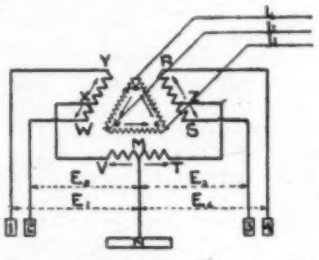

FIG. 2.—METHOD OF ARRANGING FOUR-ARC FURNACE WITH NEUTRAL CURRENT.

The temperature of the hearth in a blast furnace is limited to the temperature at which the slag melts close to the tuyeres. The maximum temperature is about 1,800 deg. C., and this limits the melting point of the slag, and, in turn, the temperature of the hearth. In the electric furnace we have a temperature well above 2,000 deg. C., so that slagging materials, having a high temperature, can be employed, that is, we can have a more basic slag. The value of having a more basic fluid slag is that the sulphur is more readily extracted from the iron, and, in fact, with the electric furnace it is possible to produce pig iron which has only a trace of sulphur present. The pig iron from the electric furnace is most suitable for steel making, and consequently has a higher value than that from the blast furnace.

(To be continued.)

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

New Electric Cooking Apparatus.

We have received specifications of various new electric cooking apparatus manufactured by the BRITISH ELECTRIC TRANSFORMER CO., LTD., Hayes, Middlesex, comprising the following:—A 12-gal. boiler, 26 in. × 15 in. × 12 in. in size, made of best tin-plate with double wall, air lagged; the loading being 3 KW., and fitted with three-heat control. The unit is complete with a control panel consisting of a cast-iron box, "Zed" fuse, and "Hart" switch giving three-heat regulation. The single tier steamer is similar to the boiler in construction, its size also being 26 in. × 15 in. × 12 in., and its capacity 56 lb. (potatoes). The illustration (fig. 1) shows a new boiling plate with ground top. The loading is 2¼ KW., and its size 24 in. × 24 in. × 4¾ in. The fitting is complete, the control panel consisting of two three-heat switches and two "Zed" fuses.

Grill No. 536 is 36 in. × 12 in., and is made of sheet steel with cast-iron top. Each of the sections, of which there are two, is controlled separately, having a complete control panel fitted with two three-heat switches and two "Zed" fuses. The total loading is 4 KW., that is, 2 KW. per compartment. The frying pan is of cast-iron and loaded to 1 KW., while the fish fryer, 15 in. × 10 in. × 6 in., consists of a cast-iron oval pan and base loaded to 2 KW. It is nickel plated inside,

and the control panel, consisting of a cast-iron box, is fitted with a "Zed" fuse and "Hart" switch, giving three-heat

FIG. 1.—NEW ELECTRIC BOILING PLATE.

regulation. This fryer is also made in the size 18 in. × 10 in. × 5 in. All these articles are fitted with self-contained elements.

A Spring Cable Drum.

The small spring cable drum illustrated below (fig. 2) is for automatically winding up slack flexible cable. Slip-ring and brush connections are provided, and any number of terminals may be fitted. The drum may be made up for winding by hand, with or without gearing, in any size and for any purposes. The LONDON ELECTRIC FIRM, of Croydon, makes all types of cable winches and drums of both wood and steel, for use with current-carrying cables, for colliery sinking pumps, mine pumping, inspection of shafts, tunnel boring, &c., and fitted with worm, spur, or their patented gearing, which is self-sustaining in all positions without ratchets or pawls.

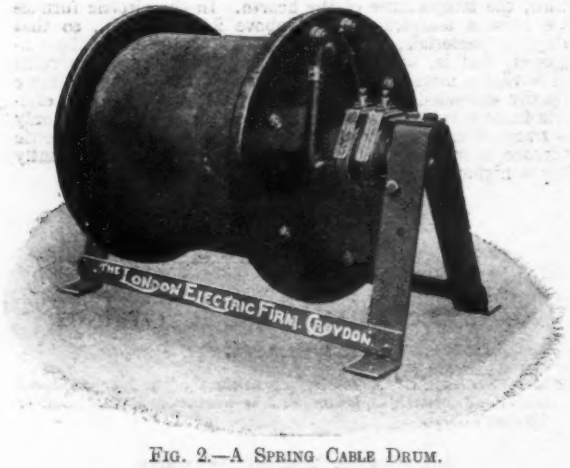

FIG. 2.—A SPRING CABLE DRUM.

Arora Fires.

We have received from the ARORA CO., of Loughborough, a new pamphlet dealing with heating apparatus. Now that restrictions are removed on materials, the company hopes rapidly to develop more cooking apparatus, and according to experimental work carried out during the last three years it is hoped that the ovens will be equally successful, and show as great progress as the firm's fires have done. Referring to our illustrations, fig. 3 shows a three-bar workshop fire, the consumption of which is 2¼ units per hour. These fires are built up by using the fire boxes from standard 2- and 3-bar Arora fires, heavy wire guards being substituted for the ordinary fronts. The W.I. brackets space the fires 1½ in. from the supporting wall. A small cast-iron cover protects the terminals. No flexibles or switches are supplied with these fires.

Fig. 4 shows a modified No. 1 two-bar fire, designed especially to withstand the rough handling in hotel use. It has a front casing of extra strength, back feet of wrought iron, and a wire handle which always remains cool. In summer these fires can be removed and stored in small space. The dimensions of these fires are 11½ in. high, 12¼ in.

FIG. 3.—THREE-BAR WORKSHOP FIRE.

FIG. 4.—TWO-BAR HOTEL BEDROOM FIRE.

wide, and 7 in. deep. Their consumption is 1½ or ¾ units per hour. They are supplied complete with 2 yd. of heavy flex, 2 switches, and a wire handle.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Early Wireless Telegraphy.

In the interest of historical accuracy, may I protest against the suggestion contained in your article on "Wireless and the War," that Mr. Marconi when he first arrived in this country failed to meet with sympathy in official circles?

This is very unfair to the late Sir William Preece, then Chief Engineer to the Post Office, who received Mr. Marconi with open arms, and gave him much technical assistance, including the use of a considerable sum of public money, which was expended in developing wireless telegraphy by numerous experiments carried out with the help of Post Office officials, including Mr. (now Sir) John Gavey.

Official sympathy with inventors is perhaps not very common, but there was certainly no cause for complaint in this particular instance.

A. A. Campbell Swinton.

Westminster, *January 25th*, 1919.

National Electricity Supply.

The letter of the Committee of the I.E.E. to the Rt. Hon. Sir Albert Stanley will, I believe, be read with astonishment and regret by the majority of electrical engineers who have at heart the reputation of "The Institution."

The Board of Trade reports are, it is generally agreed, full of imperfections. These the committee and its confederate interests are wisely prepared to overlook if they can thereby knock away the props of the whole structure through the carrying into effect of the recommendations contained in clause 7, sections (*e*) and (*g*) of the letter. Unless (1) general legislation be introduced, and (2) wide initiative be allowed

to the Commissioners, it hardly seems worth while to summon five gentlemen "of the highest ability, knowledge and independence" from the presumably useful work upon which they are now engaged, in order to delimit their activities to the duties of the Railway and Canal Commission.

Ex pede Herculem, and in the reference to that body the cloven hoof is at once apparent to anyone who knows anything of the Commission's constitution and functions.

One gathers that the really progressive undertakings, whether municipal or company, would be subjected to an interference only to be tolerated if employed for the purpose of co-ordinating their arrangements in the interests of a national scheme, and that the "stand-patters" would be free (subject to the cumbrous and dilatory procedure referred to in clause 7, section (1)), to waste coal and hinder industrial efficiency to the worst of their ability.

It is to be hoped that the "Centres" will evince their customary independence of thought on this occasion, and that they will be stimulated further to demand from the Council a more democratic consideration of the opinion of the younger men of the profession, especially now that the Institution has, it would appear, abandoned its former aloofness from material matters.

Associate Member.

January 27th, 1919.

A Protective Association for Non-Technical Officials.

I was pleased to see "Non-Technical's" letter in this week's REVIEW. I would like to point out, however, that the statement "we have no organisation to protect our interests" is not correct. The National Union of Clerks has many members who are non-technical assistants on the staffs of the following undertakings: Bristol, Brighton, Bermondsey, Bury, Battersea, Finchley, Fulham, Grimsby, Lincoln, Manchester, Poplar, Sheffield, Stepney, Southampton, and Swansea Corporations; St. Marylebone Electric Supply Co., Potteries Electric Co., Llanelly Electric Light Co., South Wales Electrical Power Co., &c., &c., and I venture to suggest that your correspondent should join this union, and thus have his interests protected. It would be absurd to start a sectional organisation for clerks in the electric power supply industry when the National Union of Clerks, with its increasing membership—at present 40,000—has all the machinery ready. Further, a guild system is now being formed within this union by which sections are formed for clerks in each industry, viz., colliery, Government, engineering, co-operative, Local Government clerks, &c. N.U.C. members in these industries can, therefore, discuss their own special problems when necessary. I think it is quite obvious that it would prove much more advantageous to clerks engaged in the electric power supply industry to become members of the N.U.C. and form a guild, than to start a sectional organisation, which could never be strong enough to have the numerical backing that appeals to employers. Further, by joining the N.U.C., if a clerk ceased to be employed in the electric power supply industry, and became engaged in a manufacturer's office, he or she would still retain their membership.

The N.U.C. is a progressive trade union affiliated to the Trade Union Congress, and only last week secured salary scales commencing at £45 for juniors, rising to £360 per annum for clerks engaged in the Swansea Corporation offices (including the electrical department). I suggest that all those interested write for full particulars to the head offices, 1, Brunswick Square, London, W.C., or to the following district offices:—

3, New Road, Woolwich, London, S.E., 18.
72, Market Street, Manchester.
63, Blonk Street, Sheffield.
95, Bath Street, Glasgow.
53, Queen Street, Cardiff.

There are branches of the union throughout the United Kingdom.

Power Company Clerk.

January 25th, 1919.

I have read with interest "Non-Technical's" letter in the ELECTRICAL REVIEW of January 24th, and agree as to the necessity of co-operation. There is an association in being, *i.e.*, the Clerical Assistants' Association (electricity supply undertakings); if this could be strongly backed up and affiliated to the E.P.E.A. it would make for the good of all concerned.

Another Non-Technical.

I was very pleased to see in your last issue the letter from "Non-Technical" pointing out the necessity of forming an association to protect the interests of the men on the non-technical side of the electrical industry, *i.e.*, chief clerks, accountants, sales, and development staff, &c.

In the light of recent events, it is perfectly obvious that those men who are not in an association or union of some kind in the future will be working under a certain handicap, and, furthermore, I would mention that at the present time the whole of the staff and men employed by electric supply companies, corporations, and tramways are all eligible, and for the most part belong to unions excepting the non-technical side of the business as mentioned by your correspondent.

Any proposal to form an association on the lines indicated would have my sympathy and support, and I hope that my fellow clerks on electric supply companies will take the matter up as far as lies in their power, in order to further our common interests and future welfare.

Electric Supply Clerk.

January 24th, 1919.

Electricity Supply Progress.

I am much indebted for the space and attention accorded me in dealing with the above subject. It is also gratifying to find that, after making due allowance for your "prejudice," we are really in agreement in regard to many of the issues involved.

Electrical science has been one continuous process of evolution, and methods modern enough at the time of their adoption have long since become obsolete.

To be admonished at this stage that we "Have done those things we ought not to have done, and left undone those things which we ought to have done" is, I am afraid, but cold comfort to those concerned. The one and only point in your comments which strikes one as distinctly odd is your assertion that many municipal engineers "share your prejudice in favour of company control." This statement is all the more difficult to understand, inasmuch as many of our most prominent municipal engineers have been recruited from service with the companies. "No man can serve two masters." How, then, can these gentlemen work enthusiastically in the interests of employers whose methods are repugnant to them? The only obvious and honourable course is for any such men to go "back to the place from whence they came, there to——" serve (more loyally, let us hope) under congenial environment. Judging from your advertisement columns there are plenty of openings (cutting out, of course, those to which our friend, Mr. Abraham, has already drawn attention), and the "advantage" would be all on the side of the companies.

You may possibly be relieved to know that I do not propose to carry "my pig any further." He is a sturdy animal, and being quite an "unprejudiced" little porker, I am content to leave him to toddle the remainder of the distance unaided.

J. C. Williams,
Engineer and Manager.
Electricity Supply and Tramways Department,
Erith, *January 27th*, 1919.

[We thought that the point which strikes our correspondent as "odd" was a matter of common knowledge. Naturally, engineers in municipal employment do not advertise their private views on the subject, unless they happen to be in favour of municipal methods, but we have listened to many harrowing tales in private conversation, and it would be easy to draw up a list of one-time municipal engineers of standing who have changed over.—EDS. ELEC. REV.]

Engineer Surveyors' Salaries.

I have been greatly interested with the several letters in the ELECTRICAL REVIEW concerning the above matter. For several years I was employed by a very prominent engineering insurance company as an inspector, and therefore know something about this question. During this period I had several small increases, sometimes £6 and sometimes £12 per year. As I was not satisfied with these small increases, I applied to another insurance company for an improved position, and was informed that I was not eligible, as the several companies had an agreement not to engage each other's officials. In fact, the poor inspector must continue to work for one particular company or leave this class of employment. This fact settled the matter as far as I was concerned, and, being fortunate at the time, I obtained a position as engineer to a private firm, where I have been treated in a much better manner. I have never regretted the step I took, and am now receiving no doubt nearly double the salary I should have been getting if I had stayed with the insurance company. I should very much like to know if the surveyors have received increases in their salaries in proportion to other branches of engineering. Perhaps someone can enlighten me on this point. I advise budding surveyors to keep clear, as I am certain they can do much better in other spheres, with the work less trying, and more consideration shown. I have sympathy with the writer of the letter signed "Electric," and advise him to change his job as soon as he can. It is a great shame that a man should spend the best part of his life, and not be appreciated. The engineer surveyors have the matter in their hands, and if they will form a strong association their salaries will soon increase by half, which I am certain they should do. The several insurance companies concerned will alter the conditions perhaps when they have lost the confidence of their clients through employing incompetent men at a low salary. I always found that the older surveyors were very competent and practical men, with the younger surveyors less competent. Perhaps the E.P.E.A. or E.T.U. will form a branch for the inspectors.

Old Inspector.

January 25th, 1919.

I fully endorse Mr. A. J. Abraham's letter. The salary offered—£150, plus £25 war bonus, with increases according to merit—is at present more than equalled by ordinary wiremen in certain districts, some of whom I wouldn't pay with iron washers, let alone money. These men get employment in all parts of the country, and install electric light and power circuits, under supposed contractors' supervision, in buildings that are afterwards fully insured. I can confidently state that it takes a good practical man, who has had years of experience in installation work, to know where to look for the likely bad work. It takes more than a testing set with a technical, trained man using it, to find it. Of course, it is essential that he be fully trained technically, otherwise he is useless.

All I hope is that they get the inspectors at the salary offered.

J. Cookson.

Blackpool, *January 24th*, 1919.

The Shorter Working Week.

I have read with much interest the letter in the current issue of your paper by Mr. H. H. Morton, referring to the shifts worked by the City of Manchester power station employés on the 47-hour basis. I note that an effort has been made to overcome the 12-hour change-over evil during week-ends, which I should like to see stamped out in London; but it puts another obstacle in the way in doing so. According to the tables set out in Mr. Morton's letter a shift hand may have a Saturday afternoon, a Monday night, and a Thursday morning off once in three weeks, but *never* does he appear to be able to get a *Sunday*. This, I will admit, will change the query of the kiddies as to "who the man is that is at home *sometimes* on Sundays?" but will replace it with, "Mother, who is daddy?" Surely some scheme can be adopted so that a shift hand has a Sunday off, say, once in six weeks at least. Another hardship lies with the relief man, who has to work the time the shift hand is off. What sort of week can he have when he had to dodge about on three different shifts each week? He gets in according to the tables 27 hours shift work as relief man spread over Saturday afternoon, Monday night, and Thursday morning (eight hours each), and Wednesday afternoon (three hours). How does he get in his other twenty hours during Wednesday and Friday unless he does ten hours each day in addition to the time he has worked on Wednesday afternoon, or, perhaps, he doubles back on Tuesday?

If he has to do this, I think he deserves his Sundays off. But how many men are willing to do it? Very few, I'm afraid. Another thing to watch is when men will be required to work reliefs for two jobs, as will no doubt be necessary in small power stations. Then it will be a practical impossibility for him to work on these lines. Some other method will have to be adopted, which no doubt can be done if only employers will take their staffs into their confidence in the matter, for what may suit the conditions in one station may be absolutely unworkable in another. To get over the whole difficulty, it is necessary to have six working days of eight hours in each week, with an occasional Sunday off, which should be at least once every six weeks. If this is not done, I can definitely state that much discontent will be caused in the London area, which, I think, everyone is trying to avoid.

William H. Streeter.

(*Financial Secretary*, Marylebone Branch, National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen, and Electrical Workers.)

London, *January 25th*, 1919.

Electrical Contracting.

Apparently Mr. Fowler is of the opinion that only large firms such as the one he represents should be enabled to carry out electrical contracting; may I be allowed to put in a plea for the small contractor? in many cases a workman who has started in business for himself, and who therefore thoroughly understands his work. The supply companies have rules and tests, and if these are complied with, why worry?

G. Wallace.

London, W.C., *January 25th*, 1919.

Moisture in Low-Grade Fuel.

Mr. Morinan's letter of the 13th inst. refers to possible methods for removing the moisture from small fuel.

It would doubtless be interesting to many of your readers to know what proved methods there are already on the market for effecting this.

Perhaps those having information on the subject would be willing to communicate it through the medium of the "Correspondence" column of your journal.

F. G. Fryer.

York, *January 23rd*, 1919.

[Several letters have been unavoidably held over.—EDS. ELEC. REV.]

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

884. "Electric sparking plugs for internal-combustion engines." A. R. KAHL (A. A. Radke & O. M. Leich). January 13th.

888. "Generation of electricity in connection with internal-combustion engines or steam generating plants." C. W. BROCK. January 13th.

889. "Cooling dynamos, electric motors, &c." C. H. LAUTH. January 13th.

903. "Electrical apparatus for prevention of corrosion in steam boilers, &c." A. S. GUSH. January 13th.

910. "Electric light sockets." H. H. MELAUN. January 13th.

913. "Spark plugs." W. W. BUGH. January 13th.

919. "Telephone systems." H. G. SHRIVELL. January 13th.

928. "Sparking or ignition plugs." E. LEYMARIE. January 13th. (France, April 15th, 1918.)

929. "Electrical measuring instruments." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. & G. A. CHEETHAM. January 13th.

955. "Electrical apparatus." J. C. TODMAN. January 14th.

965. "Variable condensers for wireless telegraphy and telephony." E. E. G. BOITE & W. H. EDRIDGE. January 14th.

967. "Magnetos for ignition purposes." E. A. SMITH. January 14th.

989. "Sparking plugs." D. DOUET. January 14th.

993. "Telephonic systems." E. A. GRAHAM. January 14th.

1,009. "Electrically-driven vehicles." A. R. ANGUS. January 14th. (Sweden, January 14th, 1918.)

1,012. "Signalling and otherwise utilising radiant impulses." R. A. FESSENDEN. January 14th. (U.S.A., January 14th, 1918.)

1,044. "Trolley wheel mechanism of overhead electric tramway systems." W. R. JENKINSON. January 15th.

1,071. "Electric batteries." E. H. NAYLOR & S. F. TYLER. January 15th.

1,081. "Telephone systems." G. E. TURNER. January 15th.

1,115. "Sparking plugs for internal-combustion engines." V. JOLY. January 15th.

1,123. "Resisters for electric furnaces." W. TRAVIS & T. H. WATSON AND CO. January 16th.

1,129. "Electrified vibrator." J. A. RAWLINSON. January 16th.

1,133. "Sparking plugs for electrical ignition systems." A. OGDEN. January 16th.

1,155. "Series-wound electric motors." E. STIRK, G. STIRK, J. G. STIRK AND R. STIRK. January 10th.

1,251. "Magnetos for ignition purposes." E. A. SMITH. January 17th.

1,255. "Electric switches." R. B. BENJAMIN & A. N. NELSON. January 17th. (U.S.A., May 4th, 1918.)

1,259. "Translating a number of small reciprocating or vibratory movements into substantial unidirectional movement." AUTOMATIC TELEPHONE MANUFACTURING CO. & S. R. SMITH. January 17th.

1,266. "Combined electric switches and plug connectors." J. H. FARTHING, J. B. LEVER & M. J. RAILING. January 17th.

1,271. "Electroplating." C. A. BOLTON. January 17th.

1,273 "Wireless transmission systems." C. S. FRANKLIN. January 17th.

1,283. "Means for securing electric lamp bulbs to holders." J. CONDIE AND J. S. JEPSON. January 17th.

1,293. "Electric nightlight battery with detachable lamps." S. W. KENT. January 18th.

1,343. "Protective gear for alternating electric current generators." BRITISH THOMSON-HOUSTON CO. & R. M. WILSON. January 18th.

1,344. "Sparking plugs." J. A. MOREAU. January 18th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

9,305. IGNITION DYNAMOS. C. T. Mason. June 28th, 1917. (121,612.)

14,481. ELECTRIC IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. J. Courtier & P. Courtier. October 7th, 1916. (110,549.)

17,296. TEST SHEATH JOINT FOR ELECTRIC CABLES. C. J. Beaver, A. F. W. Richards & E. A. Claremont. November 23rd, 1917. (Addition to 15,821/17.) (121,623.)

17,300. CARBON BRUSHES FOR DYNAMO-ELECTRIC MACHINES. Morgan Crucible Co., C. Y. Knight & W. N. Wilson. November 23rd, 1917. (121,624.)

17,301. CARBON BRUSHES FOR DYNAMO-ELECTRIC MACHINES. Morgan Crucible Co., C. Y. Knight & W. N. Wilson. November 23rd, 1917. (121,625.)

17,529. VACUUM ELECTRIC DISCHARGE DEVICES. British Thomson-Houston Co. (General Electric Co., U.S.A.) November 27th, 1917. (121,627.)

1918.

662. ELECTRICAL REPLACEABLE FUSES. M. H. Gohlstone. January 11th, 1918. (121,651.)

1,948. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. F. A. L. Johnson. February 2nd, 1918. (121,663.)

2,081. ELECTRICAL FUSE BOXES. W. T Henley's Telegraph Works Co. and E. E. Judge. February 5th, 1918. (121,664.)

3,420. PROCESS OF MAKING IRON AND STEEL IN ELECTRIC FURNACES. E. Humbert. February 26th, 1918. (121,674.)

4,336. ELECTRICAL CONTACT-MAKING AND BREAKING APPARATUS. British Thomson-Houston Co. & A. P. Young. March 12th, 1918. (121,680.)

5,319. PROCESS FOR REMOVING RIVETS AND CUTTING METAL BY MEANS OF THE ELECTRIC ARC. Soc. Anon. l'Acetylene Dissous du Sud-Est. May 20th, 1917. (116,690.)

13,459. ELECTRIC BURGLAR ALARM SYSTEMS. H. J. Tibbles & T. Gunn, Ltd. August 19th, 1918. (121,713.)

14,242. SAFETY DEVICE FOR THE OIL TANK OF ELECTRIC TRANSFORMERS AND OTHER ELECTRIC APPARATUS. Akt.-Ges. Brown, Boveri et Cie. September 1st, 1917. (119,230.)

17,277. METHOD OF AND APPARATUS FOR ELECTRICAL TREATMENT OF GASES. L. Bradley. June 21st, 1916. (Divided application on 8,926/17.) (120,573.)

"A.E.G.": Anathema Expected Generally.—At a meeting in Brussels, last week, of the Société A.E.G. Union Electrique, it was decided to drop the three letters A.E.G., which denoted a connection with the Berlin A.E.G. concern, from the title of the undertaking.